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No. 25

Industrial Democracy in Practice in England

In reading this article, it is important for the manufacturer to remember that the trade union machinery in Great Britain is very complete and that the practice of bargaining with trade unions has been in existence for a great many years. In the engineering trades, all matters have been settled through the machinery of the trade union and the employer's organization for something over thirty years. It is because of the complete character of the organization machinery among the workers and its solid entrenchment in the methods of industrial operation that this machinery figures so strongly in the present development in that country

By Clarence H. Northcott

THROUGHOUT the length and breadth of Great Britain, it is becoming increasingly recognized that there can be no industrial peace till the demand of the workers for an increased status has been met. The more liberal employers, men like Sir Robert Hadfield, Mr. W. L. Hichens, of Cammell, Laird & Co., Lord Leverhulme and several of the most prominent members of the Federation of British Industries, are emphatic and outspoken on the point. They realize that the settlement of the industrial situation is the necessary preliminary to the re-building of British trade, and their analysis of the demands of the workers leads them to the conclusion that output awaits upon the recognition of the workers as partners in industry. Even such conservatives as the coal owners are ready to give the miners a measure of control. It is a striking fact that in the much-divided report of the Coal Commission on Nationalization, there was no one of the groups signatory to the report that did not allow for some form of representation of the miners

on the various councils suggested to direct the industry.

But how is such control to be achieved, and how will it work? The answers to both these questions are ready. A fully developed method has been outlined and has been before the country for some time. It has been discussed at meetings of employers and trade unionists alike, till no reasonably informed person can be found who has not heard of the Whitey Report. In this, the most famous report of any of the reconstruction committees set up to get ready for the post-war period, an attempt was made to secure a permanent improvement in the relations between employers and workmen by suggesting measures by which industrial conditions should be systematically reviewed by those concerned. Those suggested measures consisted of the establishment of what were called "joint standing industrial councils." They were *joint* councils, because they were to consist exclusively of representatives of organizations, that is, of employers associations on the one side, and of trade

unions on the other. These councils were not to displace, nor be used to defeat, trade unions. They were a bridge between the trade unions and the hitherto hostile employers. They were called *standing* councils, because they would meet regularly and were termed *industrial* because their unit was to be the industry.

The scheme provided for one joint national council for each industry as a whole, a number of district or sectional councils for certain districts where the industry was located or for sections of the industry where that subdivision was better than the geographical, and for works committees in each establishment. In general, the organization has been built from the top down, instead of from the bottom up. Employers and trade unionists both had in their associations the machinery ready for national organization, and were both inspired by the spirit of co-operation. It was therefore, not a difficult matter to set up these national councils, and their growth in numbers has been astonishing. The first one dates from the beginning of the year 1918 and within 21 months 50 such national councils have been inaugurated.

THE DIFFICULTIES

But strict democratic theory required that such means and measures of co-operation should be built from the bottom up. If establishments in one single industry could individually organize and set up Works Committees, these would be the first rungs in the ladder. The various establishments in a district, each engaged in the one single industry, could then organize for the district a council, the members of which would be elected representatives of the two parties in industry. By a similar delegation and representation, a national council for an industry could be set up. It is in this way that British constitutional usage operates, and that the forms of representation inherent in democracy should strictly be constituted.

Various difficulties stood in the way of such a method of realization of the Whetley scheme. The spirit prevailing in individual establishments was not so truly cooperative as that which was to be found between national organizations. The workers were not so broad-minded and tolerant as their national leaders. Local representatives of trade unions were smaller minds and smaller souls than the potential statemen of the new era. Employers, on the other hand, are often less friendly to trade unionism in their individual than in their collective capacity. The national executives of employers' associations comprise the most enlightened, liberal and progressive men in the industry. Local employers, not as large-minded, find themselves faced by continual and insistent demands from their own employees or the local representatives of the unions, demands which showed little evidence of any spirit of co-operation or any real desire to secure a permanent improvement in the relations existing between them and the workers. This absence of local co-operation has resulted in the new systems of industrial democracy being built from the top.

*Mr. Northcott is an Australian sociologist who has studied two years at Columbia University, has served on the research staff of the National Industrial Conference Board, Boston, accompanied its European Commission as investigator and statistician, and is now engaged independently in economic and industrial research in Great Britain.

Yet in spite of such difficulties works committees have been set up in many places. Even before the war instances of them were found, while the war and the need of increased production prompted many others. It must be acknowledged that some of the latter were associated with the rise of the shop steward system, and that the revolutionary nature of the latter argued badly for any spirit of co-operation in such works committees. One who meets a Glasgow employer and hears his whole-hearted condemnation of such co-operation with labor, must remember what a bitter experience his has been, and with what untypical elements of British trade unionism he has been compelled to deal.

A capital illustration of the effective working of such a works' committee is available. Its record shows alike the conditions under which success can be achieved and the measure of co-operation that is possible under favorable conditions. The industry concerned, that of cocoa and chocolate confectionery, is one which the war has restricted in one direction, while creating a large demand for some of its products. This demand still exists, so that the firm wants every ounce of production that its employees can give. Economically, co-operation that will secure an increased output, will be a paying proposition, even if it entails higher wages and shorter hours. Quantity of output to meet the demands of a claimant market is the economic measure of the value and cost of the co-operation needed.

But the particular firm of Rowntree & Company, York, England, in which the experiment has been made does not measure its interest in its workers merely by the quality of output they give. It is one of the firms best known in all England for its welfare activities. It has set a high standard of care for the health and welfare of its workers. It has had employment managers for men and women for many years, while welfare supervisors are now found in any department where girls and women are employed. It provides a good, substantial lunch at a cheap price. It has a doctor and dentist upon the works all day, with an oculist calling twice a week. Its pension fund enables its workers to provide for their old age, not entirely by their own subscriptions, but by the addition yearly to the pension fund of a contribution from the firm equal to nearly three times the combined contributions of the members. The story of its welfare activities and its attention to the health, interests and needs of its workers is too long to tell in detail. It is only necessary to add to this bare statement of its enlightened attitude towards its workers that it is an establishment where trade unionism is, and has been, encouraged, where departmental or "shop" councils have been in existence for more than two years, and where every condition precedent to a successful experiment in industrial democracy is realized.

DEPARTMENT COUNCILS

More than three years ago, this firm came to the conclusion that managers and foremen could be helped by departmental councils. They proclaimed their belief that through such councils the employees could feel themselves to have a real share in the administration of the department, whilst their co-operation would be heartily welcomed by the management. Such general subjects as the comfort and well-being of the employees and the general efficiency of the department were afterwards translated into the following definite matters for consideration by such a council:

- (1) The criticism of any piece wage not thought to be fair or adequate, and the consideration of suggestions for adjustment.
- (2) The consideration of conditions and hours of work in the department.
- (3) The consideration of departmental organization and production.
- (4) Rules and discipline.

After long and careful discussion, in which the operatives and their trade unions were consulted and modifications made in the original proposals in consequence of their suggestions, a council was set up in one of the departments. When the success of the experiment had been demonstrated, the system was extended to every department.

From January, 1919, a Central Works Council for the whole establishment has been set up. On it the workers are represented by 27 delegates, a large number, but one defended on the ground that it is more vital to have each department represented than to have a small council. The management has an equal number of representatives, several of the directors and most of the managers accepting the position of delegate. The Chairman of Directors, Mr. S. Seebohm Rowntree, was elected chairman of the council, and one of the most responsible of the workers' delegates became vice-chairman. It is indicative of the large measure of control over executive functions which the council was likely to undertake that the vice-chairman immediately pointed out that, as he was not a director, he would not be familiar with many matters that might come up for discussion, and asked for the appointment of another director of the company to be "deputy chairman to assist the vice-chairman." This request was acceded to by both the meeting and the director named.

SATISFACTORY WAGE STANDARDS

At the opening meeting, Mr. Rowntree, whose writings work him out as a man of large vision and progressive ideas, gave an address on behalf of his fellow directors. He said that for a long time it had been the desire of the directors that the workers should have more influence in determining the conditions under which they had worked. Before launching any scheme, they had conferred with trade union leaders, and now desired that the workers should have as large a share in the industrial management of the business as was possible without imperiling its financial stability. The directors of the company felt that they must retain the power of veto over any decisions come to by the council, but they conceded to the trade unions a similar power of veto over measures which specially concerned their interests.

The speaker was convinced, however, that both the directors and the trade unions would be very slow to exercise their veto over any decision which had been come to after serious consideration by the council, and which had the approval of a fairly large majority of its members.

An essential condition of well-being which the Council should seek to establish was a satisfactory wage-standard throughout the mill. To carry out this end, an adequate proportion of profits must be earned. When normal working conditions were re-established, competition would tend to narrow profits, and it was, therefore, absolutely essential that the cost of production should be lowered in order to maintain a high wage standard. There must be a higher standard of efficiency, in the sense that every effort on the part of a workman should be directed in the best possible way. The speaker realized that the workers would want to know how they were to benefit through any increased efforts made on their part. This was a very difficult problem, but one which the Council could probably do something to solve. It could at least seek to find the best method of ensuring that the worker should receive a fair share of any results which might be obtained through increased effort or efficiency on his part. The Council could, too, attack the problem of unemployment, for this problem, in the speaker's opinion, must be solved before the hearty co-operation of the workers could be obtained in securing increased efficiency.

Other problems which the Managing Director hoped the Council would discuss were the possibility of reducing working hours without reducing output; the relative advantages of the various wage systems obtaining in the factory; lateness and absence of workers; the best methods of promoting workers; training for administrative posts; education and recreation.

With regard to trade unions, he emphasized the fact that the council was not intended in any way to undermine their authority. It was to be hoped that cordial and harmonious relations would continue between them and the council. The directors had consulted the trade unions on the matter of the council and had been assured of their approval. They would continue to consult them on big issues which affected their members.

It is an interesting confirmation of this attitude that in either the sectional or the general works councils the firm recognizes the right of the employees "to have the attendance of a permanent official of their union, not necessarily in the employ of the firm, during the discussion of any matter on which they consider it essential that they should have skilled assistance and advice."

One of the earliest subjects brought before the new Works' Council was that of the election of foremen. It was proposed by the workers' representatives that in some form or other, they should have the right to elect their own foremen. This was vigorously opposed by the representatives of the management on the grounds that responsibility for the success of the business rested upon them and that the foremen stood at the beginning of the administrative ladder. Eventually, after a discussion which was educational and illuminating, it was decided that before a foreman is appointed in any department, the name proposed by the management should be considered by a small committee of the workers in the sectional departmental council, with power to submit other names for consideration. The final decision, however, concerning the appointment was to rest with the Managing Director of the department. This resolution was unanimously carried by the Works' Council.

Directly upon this resolution followed one, moved and seconded from the workers' side, urging that steps be taken to educate foremen in order that they might be better fitted for the discharge of their duties, these educational measures, however, to be open to the rank and file. In consequence of this resolution, courses of lectures in industrial psychology and economics have been given at the works to all who cared to come, while week-end conferences have been regularly held in various places in Northern England, to which a certain number of managers, foremen and forewomen have gone at the firm's nomination and expense.

Soon after the setting up of the Works' Council, a 47-hour week was accepted in the industry, while the larger firms proposed to adopt a 44-hour week. The whole situation in connection with the reduction to 44 hours was fully discussed in the Works' Council, and referred to the departmental councils for endorsement.

Needless to say, the shorter week was adopted, and the distribution of the working hours submitted to ballot. By an overwhelming majority, the employees decided to complete the 44 hours in 5 days, leaving Saturday entirely free. This decision they adhere to even in winter, though work commences at 7:30 a. m., which is very shortly after daybreak of a December morning.

One of the most interesting indications of the psychology of the workers' mind was revealed in a matter which was not the concern of the Works' Council, but was reported to it for its information. The firm's employees travel by trolley car, and the town corporation endeavors to provide accommodation for the rush at lunch hour and after the closing of the works. This accommodation had not been satisfactory and unpunctuality had also resulted from an erratic and badly organized trolley service in the early mornings. Complaints had been made, often to the car conductors, but nothing had been done. At a meeting of the Works' Council it was reported that the workers' section of the tramways works council was willing to meet the employees of the establishment to discuss the complaints. While the Central Works' Council declined to consider the matter, one of the departmental councils took it up. The members of this council at first proposed to approach the tramway authorities through their fellow workers on the tramway works council, in order to secure co-operation among the workers

in both industries. But when the new departmental committee was ready to take action, it sent a deputation to the Tramway Traffic Manager, the true official head, and, from the standpoint of discipline and efficiency, the correct person to approach.

One other instance of the discussion of a proposition vitally concerning management and workers is all that can be cited. The firm, at the close of the war, had 1,500 enlisted men who would return to them. At the same time, they had nearly 1,000 temporary men employed, many of whom were fit and capable of permanent employment, but could not be placed on that status till the soldiers had returned to their places in the factory. Large and comprehensive plans for dealing with all these temporary men, covering conditions of employment, pension provisions and a fund for unemployment benefit, were brought before the Central Works' Council by the Chairman of Directors. These plans were discussed fully, then referred for separate discussion and subsequent endorsement, in practically the original form, to the workers' part of the Works' Council.

The success of this Central Works' Council has not been uncheckered. After some six months' experience, the leaders of the chief unions represented in the establishment interviewed the directors. The complaints made by the workers were that the administrative staff merely referred matters to the council, the directors reserving the right of veto, thus making the alleged share in control little better than a farce. It was thought that the workers would be better satisfied with quarterly meetings of a central council composed of workers only, held to discuss grievances, improvements and so forth.

It was easy to dispose of both points, for the directors had conceded the trade union leaders the same right of objecting to the decisions of the Works' Council as was enjoyed by the directors. Further, the council, even in the form objected to, was a better body than a "committee on grievances" would be, for the latter would have no definite standing, and no influence, upon managerial problems. The procedure of the Central Works' Council also allowed for two measures that met this complaint. In the first place, the workers' representatives, if desirous of conferring upon some matter on the business sheet, could hold a regularly convened meeting prior to the meeting of the Works' Council. Also, during the council meeting, either side might withdraw to discuss a common policy.

This discussion was fruitful in removing suspicion. The workers' spokesmen explained that many men misunderstood the purpose of the council, and felt that it has been set up principally in the interests of the firm. They did not want the scheme dropped, but improved upon. The directors

asked that proposals for improvement should be formulated and communicated, when they would again be discussed in common, and submitted to the Works' Council. In consequence of these suggestions, a new election was decided upon, chiefly on the ground that considerable alterations in organization of departments had resulted from the return of men from the army, and the consequent transfer of workers between departments. At the final meeting of the Central Works' Council, prior to the new election, a workers' representative expressed, on behalf of his side, the feeling that the council had been valuable in bringing the operatives into touch with the administration, and had made for a mutual understanding of one another's point of view.

A PROTECTION

This result is the supreme test of the value of such co-operation among workers, employers and administrative staff. Suspicion, which is the bug-bear of the British industrial world, dies out in such an atmosphere. This has been proved several times in the history of the departmental councils in the establishment. When the unions sought to break up the departmental councils in their early months, they signally failed in one particular department. In this case, the workers and the administrative staff had, in mutual agreement, evolved a collective piece system that was remunerative and highly efficient. Every worker in the section was covered by it, whether his work was the least skilled or the most skilled. This successful attempt at a measure of control over the conditions of work and remuneration produced a real spirit of co-operation that was proof against trade union suspicion.

The representative method also allows for the protection of the workers' delegates against the misrepresentation of their fellows. One of these, who was also a local trade union secretary, complained at the departmental council of which he was a member that the action of the workers' representatives had been seriously misrepresented in the shop, and asked and obtained permission to call a general meeting. He was able at the next council meeting to report that the misrepresentations had been effectually answered.

In this same council the management asked for suggestions concerning improvements. Many suggestions were at once made for greater comfort, safety and efficiency. When it was shown that improvements might throw men out of work, the management gave a promise that no man should be put on short time or discharged through economy in production or the introduction of better machinery.

In another department the capacity of the workers to contribute to efficient management has been demonstrated. In the departmental council they worked out with the manager a system of collective piece. In itself this tended to enlarge the output.

Power Economy Due to the Differential

SOME figures regarding the loss of power which results when a vehicle is operated with its two driving gears solidly locked together, that is, without a differential gear, were given in a paper by C. G. Conradi, read before the Institution of Mechanical Engineers.

Tests were made with a $\frac{3}{4}$ ton Electromobile truck. The vehicle during the different tests was run over the same course by the same driver, and under the same weather conditions. It was designed for a speed of 15 m. p. h., and weighed, complete with battery, 3,400 lbs. The electrical equipment consisted of a 60-cell A 4 Edison battery supplying current to a double commutator motor and with a modified series parallel system of control. The chassis was arranged with an all-gear drive, the motor driving the live axle through double reductions, double helical gear, while a bevel differential of normal type was fitted. The differential was securely locked when required, by the insertion of brass blocks between the pinions and meshing with the same, no

movement being then possible. The current consumed was measured by a Sangamo ampere-hour meter, and showed current as charged to the battery, not battery output, as is more generally the case.

It will be observed from the tabulated results that both light and loaded consumption of current is greater when the differential is out of action, the percentage difference increasing with increase of load. This is to be expected, as with increased load the tires will grip the road better and more power be required to cause one wheel to slip when travelling on a curve.

Condition of differential.	Load	Miles	Ampere-hours	Saving, per cent
Locked	Light	18.1	100	5.52
Free	Light	18.1	93	5.13
Locked	11 cwt.	18.1	125	6.90
Free	11 cwt.	18.1	110	6.08

New Italian Farm Tractor Suited to Varied Work

Pavesi and Tolotti, Italian Engineers, have designed a four-wheel drive farm tractor which is adapted to plowing, road work, pulling binders, etc. When plowing light soil it will pull six bottoms. Its construction is described here in detail

PAVESI & TOLOTTI, the two Italian engineers who several years ago developed a special traction wheel for artillery and agricultural tractors, have become converts to the four wheel drive system and have constructed a tractor embodying this feature. This machine is shown in the accompanying photograph. The tractor has a frame made in two parts, which are free to move relative to each other in all directions. The front part, which is supported upon one of the axles, carries the power plant, differential, transmission for driving the front wheels, control, steering gear, seat, radiator and fuel tank. In steering, each axle turns around its center. The frame is very flexible, and where the ground surface is very uneven, the two axles may accommodate themselves to it without racking the machine.

Substantial radius rods connect the front axle with the frame, all impact being absorbed by heavy springs. A similar mount-

ing is employed for the rear axle. The four wheels are of equal size, 48 in. in diameter by 10 in. in width, and all are driven by chains which are enclosed in dust-proof housings of sheet metal.

The engine is a double cylinder opposed type, delivering 25 h. p. on the brake. It is of 5.12 in. bore by 6.7 in. stroke and operates 900 r. p. m. Engine and gearbox are combined into a unit powerplant. Two different speeds are obtained, a plowing speed of about 2 m. p. h., and a road speed of 4 m. p. h. These two speeds are obtained from the gearbox joined to the engine, and after the power has passed through this gearbox, it is distributed to the front and rear axles respectively, the connection from the gearbox to the rear axle being through a shaft with universal joints which is clearly shown in the photograph.

The designers of the Pavesi "Aratrice" have aimed to suit the machine for the greatest variety of uses. When plowing in light soil the tractor will pull a considerable number of bottoms, six being shown in one of the photographs furnished us. In that case all of the wheels run on the unplowed ground. On the other hand, for deep plowing in heavy soil only one or two bottoms can be pulled and then the wheels on one side must be run in the furrow in order to bring the center line of draft close to the center line of the tractor. For such work the two left wheels can be raised as much as needed to bring the tractor level. Individual chain drive admits of a ready raising and lowering of a wheel by swinging it around the axis of the jackshaft.

This tractor can be turned around in a circle of 22 ft. In addition to use for plowing, it is intended for road work, as well as for pulling binders, seeders, etc., and for doing belt work. Only very small cleats are used on the four wheels, and these are of such design that they need not be removed for road work. The machine complete weighs about 5200 lb. It has a wheelbase of 80., and a tread of 57 in.



Four wheel drive tractor at work

IT has been suggested by their trade commissioner, who is now making a world tour, that British motor manufacturers should produce co-operatively a type of car suitable for use in British colonies and countries overseas where made roads are conspicuous by their absence. He has suggested, also, a co-operative depot and central stores for spare parts in different districts. An announcement to this effect was made at a dinner given by the council of the Association of British Motor Manufacturers by the chairman of the association, who added that steps were being taken to give effect to these suggestions.

Truck Engineers Foresee Greater Use of Pneumatic Tires

Large and small types of commercial vehicles will ride on air in place of rubber, is a message from the joint session of the Detroit, Cleveland and Akron members of S. A. E., who spent two days discussing the subject. Tire companies are anticipating such a change in production

By J. Edward Schipper

THE use of pneumatic tires on trucks will be greatly increased on medium and heavy capacities and become practically universal on smaller sizes, if predictions made by leading truck engineers assembled here, hold true. A two-day session, attended jointly by the Detroit, Cleveland and Akron members of the S. A. E. and devoted strictly to this subject was held at Akron, O., Dec. 2 and 3, and the impression gained from it is that a tremendous impetus will be given to the use of pneumatic equipment on trucks.

The meeting was held at the plant of the Goodyear Tire & Rubber Co., where, at its invitation, a joint meeting of the Cleveland and Detroit sections of the S. A. E. was called for the purpose of going into this matter. A series of papers was presented by Goodyear engineers and was discussed by the truck engineers.

The first day of the meeting was given over to demonstrations of large size pneumatic equipped tires and, particularly, a six-wheel vehicle with four driving wheels, developed by the Goodyear company as a possible solution of the problems peculiar to the heavy-capacity pneumatic trucks. The afternoon was devoted to a visit through the plant and the evening to a dinner at which F. A. Seiberling, president and general manager and P. W. Litchfield, vice-president in charge of production, outlined the future policy of the Goodyear company along the lines of large size pneumatic and cord tire development and their relationship to the future use of the truck as a medium of transportation.

The second day of the meeting was devoted to the presentation of the papers and their discussion. The discussion clearly brought out the fact that few if any of the truck engineers doubt the greatly increased use and, possibly, the eventual exclusive use of the pneumatic, although the latter condition is by no means in sight as yet. It also brought out the fact that gear reductions, engine speeds and other performance factors will have to be considerably revised in order to make the truck suitable for pneumatic use.

F. A. Seiberling, in addressing the members at the dinner which closed the demonstration side of the program and opened the discussion, struck the keynote of the topics covered in detail by the Goodyear engineers.

"For 70 years," he said, "the railroad has been dominant, but during the last 20 years has come the gasoline engine and it will revolutionize the present methods of transportation."

He recalled the first use of the pneumatic tire on the New York buses and its failure. He told how this failure had eventually given way to success by the use of improved fastening methods. Seiberling stated that the future of the Goodyear company would be largely concerned with cord tire develop-

ment and that, perhaps, in the near future, no more fabric tires would be made. He pointed out the boundless possibilities of trucks so equipped on the improved highway systems of the country and he intimated that all manufacturers should put themselves behind the program of good road building. He insisted that the roads be wider than 18 ft., except in sparsely settled districts.

Summarizing the other remarks made by Seiberling.

"Cars will be designed particularly for the good roads systems after the roads have been built; and these cars will not be intended to travel extensively on other highways. To illustrate the ramifications of the good road extension, the Chinese situation may be mentioned. At present there are few if any developed highways, consequently the sales possibilities for automobiles and trucks have been limited in that country, despite its 400,000,000 inhabitants. With the development of roads, the possibilities for the introduction of motor truck transportation are even greater than those of the railroads. In fact, trucks may take their place even before the railroads get a chance to build."

TO USE 12-INCH PNEUMATICS

In closing, Seiberling ventured the prediction that in three years solid tires would be dead and that their place will have been taken by cord pneumatics on the medium and large size trucks.

P. W. Litchfield predicted the general use of 12 in. and larger pneumatics for heavy trucks. His address was largely concerned with the use of the motor truck or bus as an answer for the street car problem which is so greatly affecting the medium and larger cities throughout the United States. In this connection, he said,

"The street railway must be put under ground in the congested areas. Both street car and bus transportation cannot be used together over the same streets. One or the other must go as the congestion is worse when both methods are attempted."

"Traffic must be kept in motion and this cannot be done with street cars. They must go because they concentrate population and prevent the natural growth of cities because of the necessity for living near the tracks. The passenger vehicle will not be a success until it is made in larger capacity. For interurban use, the truck has also its possibilities, particularly in new lines where the initial capital required is much less than for street railways. The pneumatic tire is necessary for this work, not only because of the comfort of the passengers but because of the greater speed or, in other words, the greater carrying capacity per unit of time."

"We do not as yet know all there is to be learned regarding the limits of ratio of diameter to circumference. It is a problem in the large size tires to keep the bodies down so that the center of gravity will not be too high. The answer seems to be the use of multiple wheels in sizes above 3 tons. This can be done by mounting the wheels on a truck, beneath the rear, resulting not only in lower bodies but in better traction.

FREIGHT CAR COMPETITION

"In the future we are going to find the motor truck a great competitor of the freight car. The average daily mileage of a freight car is about 20, but the truck range is much larger and it can move when it is desired. It is not held up by other cars and other shipments. In South America, where there are no railroads, the development will be slow until the motor truck comes to the rescue. In China, a thickly populated, undeveloped country, 50 per cent of the population is concerned with transportation,—in the United States, it is about 7 per cent. This largely accounts for the poverty of a vast majority of the huge Chinese population."

The papers and the authors who presented them at the symposium were as follows: "Why Pneumatic Tires for Motor Trucks," W. E. Shively; "Data on Pneumatic Tires and Rims as Used," Burgess Darrow; "What Needs to be Done to the Truck to Have it Match the Pneumatic Tire Equipment," E. W. Templin, and "Personal Experience in Developing Standard Trucks to Run on Pneumatic Tires," M. D. Scott. The authors are all of the Goodyear engineering and experimental staff and the papers were designed to present a complete review of the tire manufacturers' side of the question to the truck engineers for discussion. Following are summaries of the facts presented in each of these papers and a resumé of the discussion offered.

Summarizing W. E. Shively's paper on "Why Pneumatic Tires for Motor Trucks?" the author points out that the development of the motor truck has been limited by the solid tire. On every other type the solid has been replaced by the pneumatic, but since the tire manufacturer has not kept pace with the truck maker, and had not perfected a large enough pneumatic, solids had to be used. The sole difference between the solid and the pneumatic is the difference between the elasticity of rubber and of air. It is easy to picture the riding comfort for a passenger car mounted on solids. In a nutshell, the advantages for the pneumatic are increased cushioning and increased traction.

Increased cushioning leads to six advantages—speed, economy, less depreciation of fragile loads, easier riding, less road depreciation, lighter weight. They were discussed separately under these heads:

Speed—Guarantees on solid tired trucks hold up to 12 m. p. h.; on pneumatics 20 to 35 is common.

Economy—Carefully kept records show consistent advantages in mileage, fuel, oil and maintenance cost per mile.

Less fragile load depreciation—Self evident.

Easy riding—Self evident.

Less road depreciation—Some States have higher tax on solid-tired truck. Particularly harmful to dirt roads on account of narrow hard tread.

Lighter Weight—Permitted in truck design because of pneumatics.

The practicability of the pneumatic has been questioned more than anything else, particularly as to changing tires. While it takes from 15 to 30 minutes to make a change, this is not to be compared to the hours saved by the use of pneumatics. There is no danger with the high inflation because tires and rims are made to stand many times the pressure. The rise in pressure due to heating a tire will never amount to more than 35 lb. Large tires do not go flat suddenly, so there is little or no danger of overturning from this source.

Burgess Darrow, experimental engineer for the Goodyear Co., presented data on the pneumatic tire for trucks as compiled for that company.

"What Needs to be None to the Truck to Make it Match the Pneumatic Tire Equipment," the paper by E. W. Templin, is

concerned with practical suggestions regarding gear reductions suitable for use with the pneumatic equipment. He points out that the use of the pneumatic will have considerable bearing on the design of the truck itself and particularly as regards the transmission gearset and final reductions. He also brings out the possibility of reduced factors of safety and consequently lighter weight and the necessity for such equipment as tire pumps and spare tires and the means of carrying them.

The calculations are based on a piston speed of 1,200 ft. per min. and the following table is regarded as satisfactory in the way of road speeds.

Road Speeds

Present Solid Gear Ratios	Tire	Av. Gov. Speed	Capacity	Pneumatic Speed	Tire Size	Rear Wheel R. P. M.	Drive R. P. M.	Rear Tire Axle Gear Reduction
7-8	17	1-1 1/2	30	36"-38"	280	-265.4	1450	5.18-5.47
9-10	15	2-2 1/2	30	40"-42"	252.1-240.1	1325	5.26-5.52	
11-12	13	3 1/2	25	38"-44"	221.1-191	1200	5.43-6.28	
12-13	10-12	5	25	40"-48"	210.1-175	1200	5.72-6.86	
14-16	9	7	20	42"-44"	160.1-152.8	1200	7.5 -7.85	

Fig. 1

Other recommendations are that the brakes have at least 100 per cent more capacity than those for solid tires on account of the greater speeds and that the engine be large enough to take care of all torque requirements. Mr. Templin describes in his paper a six-wheel vehicle that will be dealt with separately in a later issue of AUTOMOTIVE INDUSTRIES.

In his paper on "Experience in the Development of Pneumatic Tires and Motor Trucks," M. D. Scott reviewed the results of the Goodyear experiments on the Akron-Boston and other runs. The initial trip from Akron to Boston required 18 days one way. The round trip of 1,500 miles is now maintained on a schedule of 5½ days. The most important part of the development work is the reduction of the body and chassis weight in relation to that of the payload. The first truck had a payload of 3,850 lb., against a body and chassis weight of 15,800 lb. Taking the first truck as a basis, and calling it 100 per cent, successive increases in the payload proportion reduced the ton mile cost respectively by 24.7, 50.6, 76.6, and 81.8, the final figure being reached through a body and chassis weight of 8,000 lb., and a payload of 7,000 lb.

ORDERS FOR PNEUMATICS

F. A. Whitten, of the General Motors Truck Co., in discussing the papers, remarked that there are one or two things which may not have been considered in the discussion of pneumatic tires. He declared that 90 per cent of the orders for trucks with the pneumatic tires come from localities where the roads are bad and also that 90 per cent of the buyers of pneumatic-tired trucks want lower gear ratios, asking for instance, 12 to 1 in place of 9 ¼ to 1. He questioned whether the pneumatic is really more efficient in city use. He also stated that the efficiency of the solid tire varies tremendously and that far better results are obtained with some than with others.

Russell Huff, of Dodge Bros., pointed out a danger of the large size pneumatic, when it is necessary to make a quick turn out to avoid another vehicle. For this reason it may be a good thing to use the multi-wheeled truck. Another question raised by Huff is the jack equipment for the large size pneumatic. He stated it to be his experience that in the larger capacities, it is difficult to get proper jack equipment and that, in his opinion, there will always be both high and low-gearred trucks to take care of differing conditions.

E. T. Birdsall expressed the idea that the 2,500 r. p. m. truck engine should be developed for pneumatic tire use. This type of powerplant, he stated, would give all around performance desired.

None of the truck engineers present was able to express definite opinions on the merit of the six-wheel truck idea, although those who rode in the sample job exhibited by Goodyear were enthusiastic as to its riding abilities.

Features of the British Post War Cars

Practically all British manufacturers have new and interesting features in the 1920 models. Some of the leading makes have been described in *Automotive Industries* and some descriptions will follow. In these articles several of the lesser known types of cars are presented by word and photographic description.

By M. W. Bourdon

THREE is hardly a single post-war model from the British factories that has not an interesting or novel feature in its design. In several cases the influence of airplane and other war practice is evident. The surprising feature is the comparative lack of "production" designs, as the Americans know them.

It is difficult for the British manufacturer to give up his idea of machine designed and built to his own complete plans in his own shop. This idea will be noted in even the descriptions of the lower priced cars.

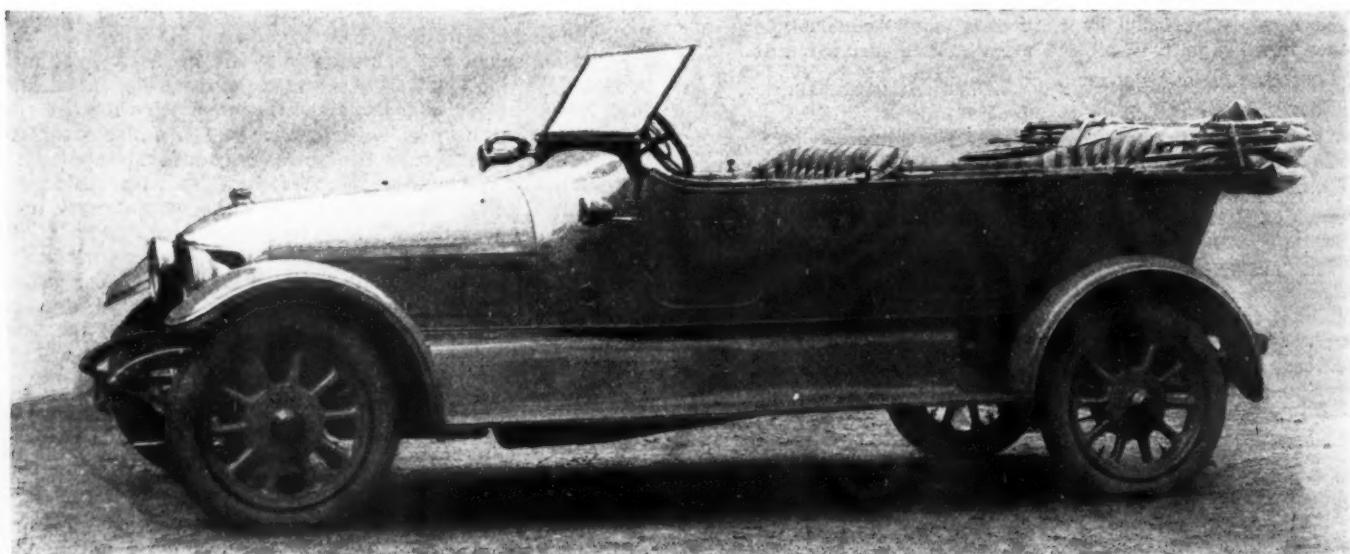
The Star

One of the oldest firms in the British motor industry, the Star Engineering Co., Wolverhampton, is continuing its pre-war two-model policy. The two chassis follow the same general lines, and have engines of the same stroke but of different bore, the 15.9 h. p. having 3 3/32x5 15/16 in. cylinders and the

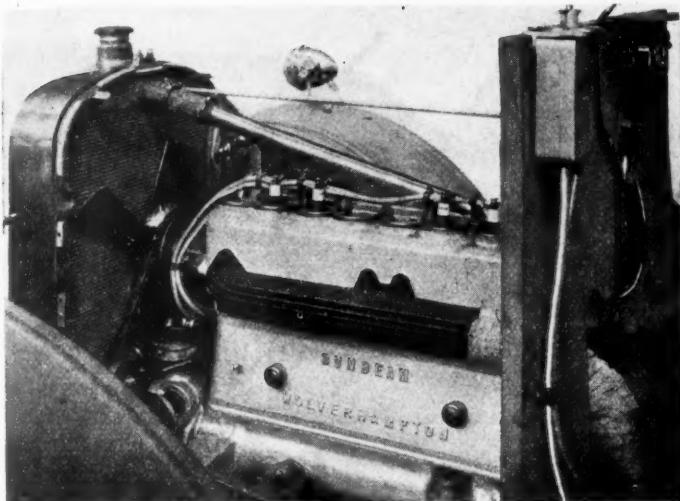
20 h. p. 3 17/32x5 15/16 in. Both types have four cylinders cast in pairs and bolted to the aluminum crank case. Lubrication is by force feed to the main journals and big-ends, while the silent chain distribution is lubricated by the surplus oil that passes through a pressure relief valve.

Pump water circulation is employed and a tubular radiator in both models, but, while in the small chassis ordinary magneto ignition is provided, the larger one has a dual type magneto with a supplementary coil and battery for switch starting, although the standard specification includes a full electrical set for dynamo lighting and engine starting.

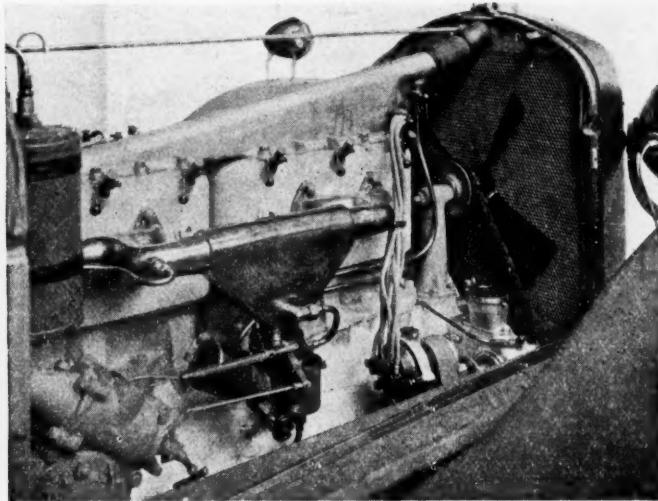
Star cars have always been known for their sturdiness and durability and apparently their makers are satisfied to rely upon their reputation in these respects without recourse to striking innovations to attract potential purchasers. Except in regard to small details the chassis generally do not differ from pre-war design. The four passenger open-body on the 15.9 h. p. chassis is sold at £690 and on the 20.1 h. p. £765.



Star 15 h.p. 5 passenger car



16 H.P. Sunbeam engine, left side



Right side of 24 H.P. Sunbeam engine

The Sunbeam

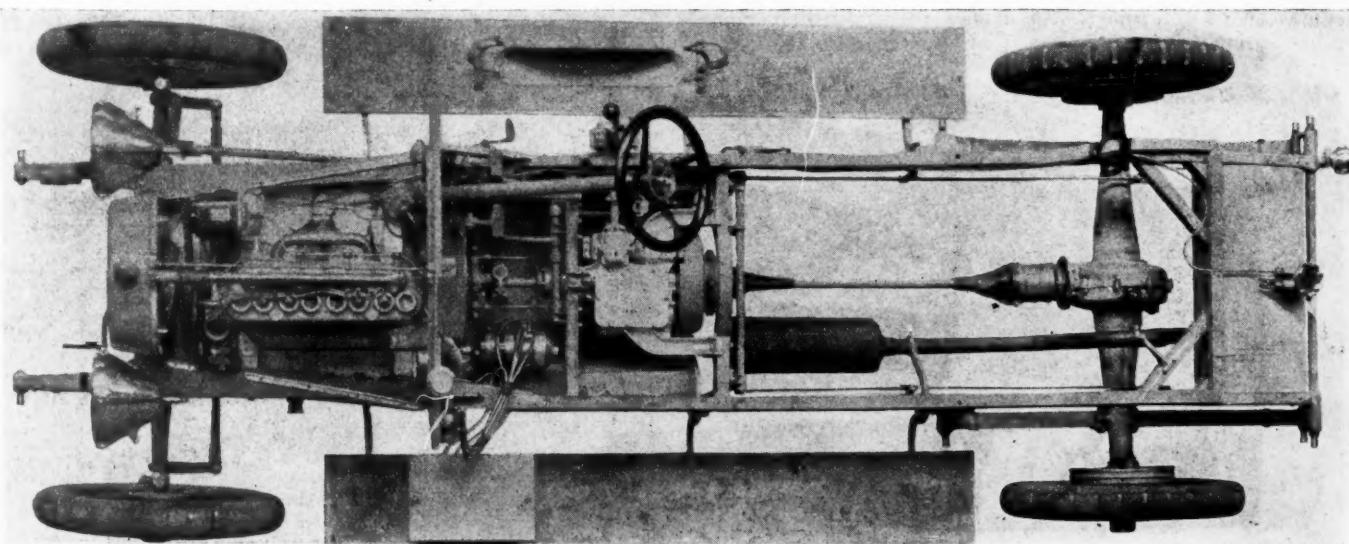
Except for detail alterations, the 16 h. p. four-cylinder and the 24 h. p. six-cylinder Sunbeam chassis follow pre-war designs. Both models have a bore and stroke of 80x150 m. m. (approximately 3½x5 15-16 in.) with valves on the left, magneto ignition, pump water circulation and hollow crankshaft lubrication, the pressure of the oil being maintained by a gear pump driven by helical gearing from the camshaft. In the case of the smaller model, the four cylinders are formed in a block of cast iron bolted to the aluminum crankcase, which is divided horizontally. The crankshaft runs in five white metal bearings, while the camshaft has five bronze bearings and is driven by a silent chain. The six-cylinder model, on the other hand, has two blocks of three cylinders, arranged and secured to the crankcase in the same way. In both models vacuum fuel feed has been adopted, which represents a variation from pre-war practice. A Clandel carburetor is fitted to the four-cylinder engine, an S. U. to the six. In both models the manifold is water-jacketed. Both engines have the carburetor on the right, the branched manifolds leading to passages formed across the cylinder blocks to the valve ports. The following general description applies to both models:

A leather-faced cone clutch with a universally jointed coupling shaft conveys the drive to the four-speed transmission, behind which is the drum of a pedal-operated expanding type brake. An open propeller shaft connects the gear-set to the

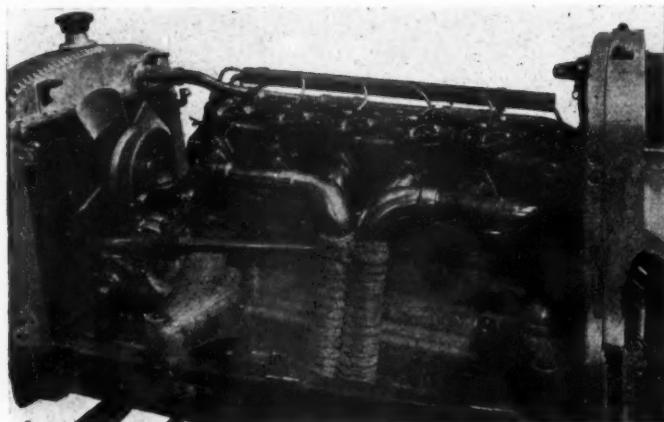
back axle, with a star type joint at the front and a pot joint behind. Helical bevel gearing for the final drive has been adopted in place of straight bevels. The back axle is of the full floating type, consisting of two steel castings bolted together at the vertical centre line of the differential casing. Torque and drive are both taken by the front halves of the rear semi-elliptic springs.

A full electric equipment is included in the standard specification: in the case of the four-cylinder model the dynamo is mounted on a bracket over the magneto, being belt driven from the fan shaft, while on the six-cylinder car a rearward extension of the water pump shaft on the left of the crank case drives the generator through a long coupling shaft with a flexible steel disc joint at each end. In both cases the starting motor acts through teeth cut on the flywheel in the usual way. A silent chain drive is used for the distribution of both models, but in the four-cylinder helical gears drive a transverse shaft, at one end of which is the water pump and at the other end the magneto. In the six-cylinder the magneto and pump shafts are driven direct by the chain of the distribution and lie alongside the engine crankcase.

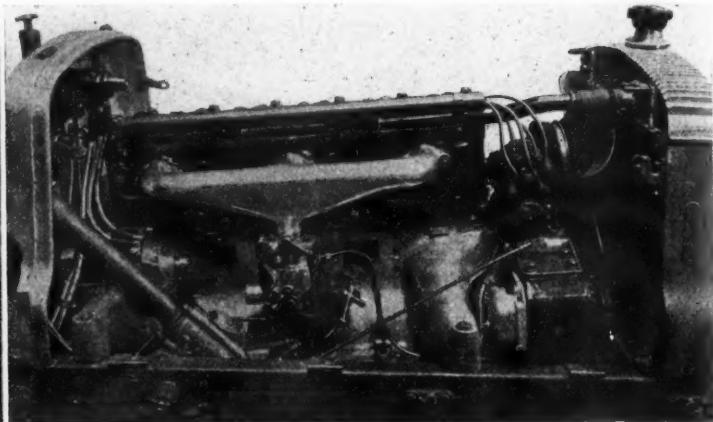
The four-cylinder engine is carried by four brackets from the main frame, with webs between them forming the under-shield. The six-cylinder engine is, however, three-point suspended, and the same applies to the gear boxes in both models. The 6-cylinder chassis is made in two lengths, 137 in. wheel base for open cars, and 144 in. for closed cars, the wheel track being 54 in. in both types.



New 16 H.P. Sunbeam chassis. General arrangement similar to 24 H.P. six cylinder



Left side of Daimler "Standard Thirty" engine



Right side of Daimler engine. The carburetor has seven jets brought into operation successively by engine suction

The Daimler

That well-known firm, the Daimler Co., Coventry, which, since the signing of the Armistice, has probably had a larger output than any other firm in Great Britain, has standardized three models for next year. These consist of the Light 30, the Standard 30 and the 45 h. p. Special. All three bear a marked resemblance and particularly does this apply to the two 30 h. p. models, which differ mainly in regard to wheel base and radiator design.

All models have six-cylinder engines with Knight sleeve valves, the dimensions of the smaller ones being 3.54x5.1 in., those of the 45 h. p. 4.3x5.1. In all cases the chassis vary but slightly from Daimler pre-war practice, having the cylinders cast in two blocks. The engine is mounted directly on the side frame members, and is set at an angle inclining toward the rear, so that a straight-through drive can be obtained from crankshaft to the underneath Lanchester worm gear. A silent chain drive is used for the eccentric shaft operating the valves, an inclined transverse shaft driving the magneto on the right and the water pump on the left.

Each model is fitted with the Lanchester vibration damper at the front end of the crankshaft.

The carburetor is of the Daimler company's own design and has seven jets in separate choketubes, the upper ends of which lead into the mixing chamber at different heights, being opened in succession by engine suction taking effect upon a sliding sleeve. One of the jets is fitted with an adjustable needle and serves as a pilot jet for slow-running and starting. A regulating needle is also fitted between the float chamber and the base of the jets, by means of which the aggregate flow of gasoline can be controlled with a view to assisting economy in consumption. On the Standard 30 and the Special 45, this

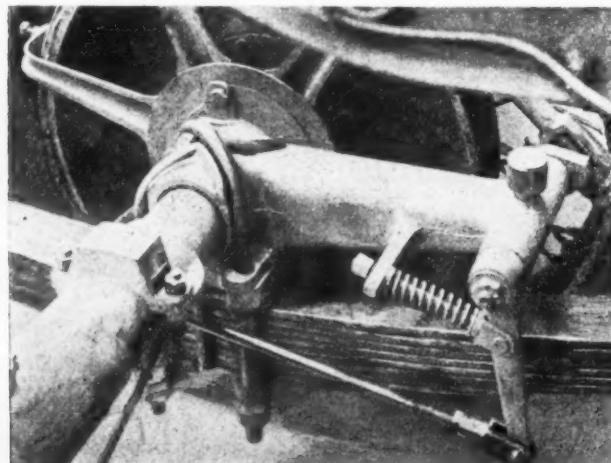
needle is controlled by a lever on the steering wheel, but on the Light 30 the control is located on the carburetor itself.

The radiator of the Light 30 is of the honeycomb type and has no filler cap, means for replenishing the water supply taking the form of a trough with a hinged lid arranged under the front of the hood. The other two models have tubular radiators and the usual filler cap. In all cases the top tank is of finned aluminum. The radiator fan is driven by a wide, flat belt, the latter being kept in tension by a bell-crank lever and spring located within the driven pulley.

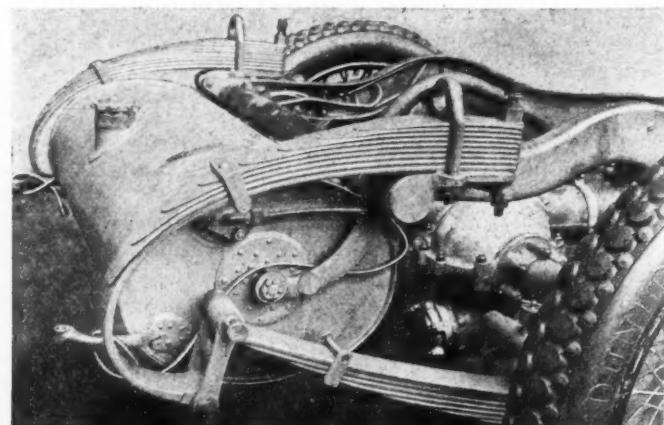
A large diameter cone clutch with an aluminum driven member and an exterior spring conveys the drive through two flexible disc couplings to the four-speed gearset. The latter has its control lever arranged in a bracket bolted to the right-hand frame member, an extension of the same bracket forming a quadrant for the hand brake lever. The gear-casing is suspended at three points; fore and aft from tubular cross members of the frame, and on the right by an integral arm bolted to the side frame member. An open propeller shaft is used, and, reversing usual practice, a sliding pot joint with unusually large bearing surfaces occurs at the front end, while a ball bearing star joint is fitted at the rear. The back axle has a cast aluminum centre with cast steel extensions.

Three quarter-elliptic springs form the rear suspension, the lower members being underslung and secured by U-bolts, which are arranged diagonally and cross one another above the axle bracket.

In producing the Light 30 chassis, the makers have in mind to cater especially to the owner-driver. The chassis is designed to carry four passengers as a maximum, including the driver, and the wheel-base is of such a length as to accommodate either an open body or an all-enclosed saloon. The chassis of this model weighs 2,800 lb. as compared with 3,025 lb., the weight of the Standard 30. Its wheel-base is 128 in.



Daimler method of supporting underslung rear springs



Method of supporting fuel tank at rear end of Daimler "Standard Thirty" frame

as compared with 141 in., while it has a gear ratio of 3.55 to 1, both the other models having a ratio of 3.77 to 1.

A point of interest occurs in connection with the method of fixing the Daimler body to the chassis. The body is partially insulated from the chassis by supporting it fore and aft only; at the rear the body is hinged to the chassis and at the front it is supported on each side by a rubber buffer. When it is desired to overhaul the chassis, the body need not be entirely removed, but can be lifted up from the front end, hinging on the line of the rear cross member of the frame.

With this arrangement in view, the bodies are built up on a steel frame which forms the base of the framework in place of the usual wooden "runners." This frame has three central cross members, which extend on each side at varying lengths, these "outriggers" supporting the outer portions of the body floor. It is claimed that this system confers great strength and rigidity on the body, saves weight, and, by keeping the body clear of the chassis, isolates the occupants from road shocks and vibration to which otherwise they would be subjected.

The Daimler bodywork for the Standard 30 and the Special 45 consists entirely of closed types, namely, limousine and landaulet. Bodies are not supplied for the Light 30, but arrangements have been made with outside firms to undertake the building of the coachwork.

In regard to prices, the Light 30 chassis figures at £1,000, the Standard 30, £1,060, and the Special 45 at £1,300. The wheel-base of the last mentioned is 146 in.

The Straker-Squire

A firm which for many years prior to the war had adopted a one-model policy, specializing upon a 15 h. p. four-cylinder, was Straker-Squire, Ltd., London. For its post-war program, this firm is continuing to make only one model, but the new type differs very considerably from that manufactured up to 1914. It has a high-efficiency six-cylinder $3\frac{1}{8} \times 5\frac{1}{8}$ in. engine, with separate cast iron cylinders bolted to the upper half of the aluminum crank case. Overhead valves are fitted, operated by an overhead camshaft, which is enclosed in an aluminum casing and actuates rocking levers projecting through the sides of the casing to the valve stems arranged along each side.

The water jackets of the individual cylinder castings have large front and rear openings closed by studded aluminum plates, separate water leads above the exhaust valves and at the bottom of the jackets being connected to gallery water pipes on the left side of the engine. The overhead camshaft, the casing of which serves to brace together the tops of the separate cylinders, is driven by helical gearing and a vertical

shaft at the front. The valves are $1\frac{1}{8}$ in. in effective diameter, of tulip shape, and have double valve springs secured to the stems by threaded spring cups and locking nuts. Pump water circulation and magneto ignition are standard.

The dynamo, which is arranged between the pump and magneto, is connected by a spring coupling adjustable for timing purposes. In the event the dynamo requires repair, it is possible to remove it, and, by placing the magneto on the dynamo bracket, to keep the car in service.

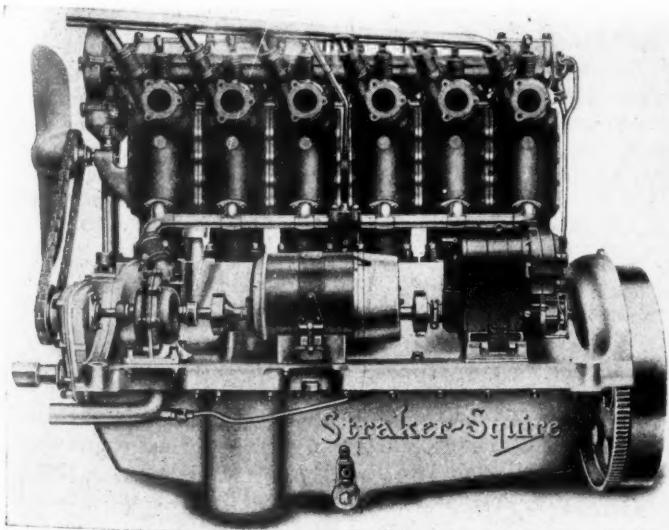
The seven-bearing crankshaft, with journal bearings $2\frac{1}{4}$ in. in diameter and pins of $2\frac{1}{8}$ in. diameter, is drilled for forced lubrication. Splash lubrication is depended upon for the aluminum pistons, which are fitted with three compression rings and one scraper. Connecting rods are machined all over, and the piston pin floats. A branch pipe from the lubrication system conveys oil to the interior of a hollow camshaft, from which the four bearings are served. The side members of the frame are parallel in plan and each is pressed in one piece, with half of a sub-frame carrying the engine and transmission casing. Apart from the engine and method of supporting it in the frame, the chassis has no very prominent features.

A single plate clutch is used and an enclosed propeller shaft, which has its casing supported at the front in a spherical bearing. Two universal joints are fitted, that at the front being lubricated directly from the interior of the transmission casing; the driven shaft of the latter is hollow and forms a channel for the supply of lubricant into the universal joint casing, the oil finding exit through holes drilled radially in the nut that holds the front half of the joint to the gear shaft. Helical bevel gearing forms the final drive. Both sets of brakes apply to the rear wheel drums, and within the axle is an enclosed drive for a speedometer connection.

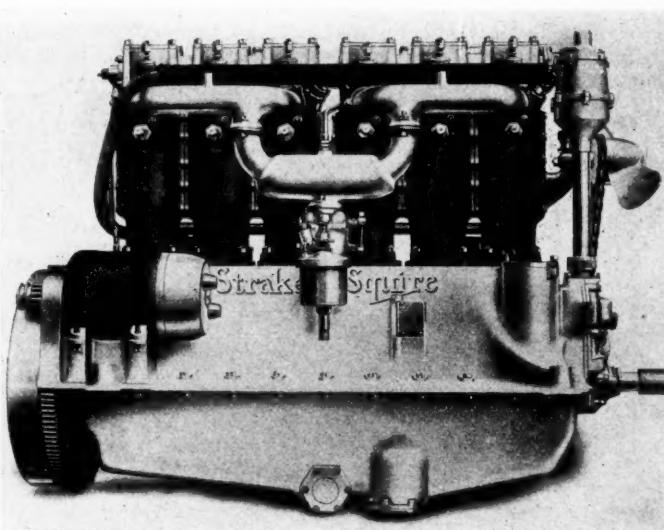
Rudge-Whitworth detachable wire wheels are standard, while cantilever springs are used at the back and semi-elliptics at the front. The engine, it is claimed, develops 70 h. p., and weighs, complete with full equipment including electric starter and dynamo, 497 lb. For the manufacture of this car a new factory, built for the production of munitions during the war, has been acquired at Edmonton, in the north of London.

The Vauxhall

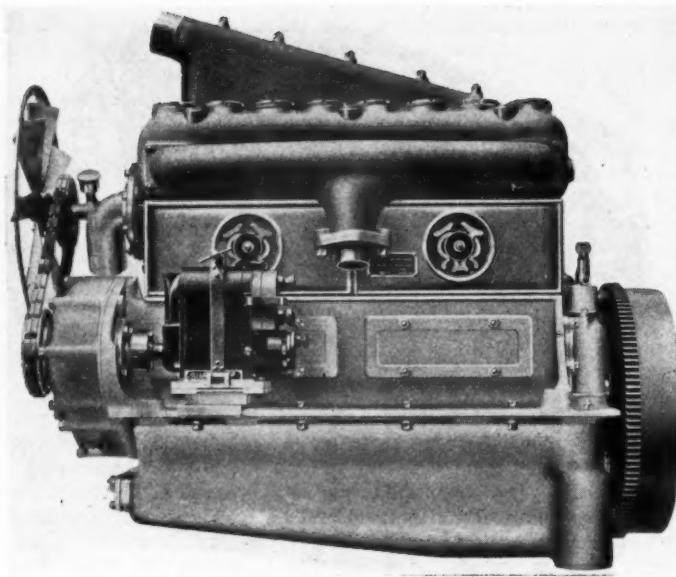
Vauxhall cars need no introduction to readers of AUTOMOTIVE INDUSTRIES, so it may be said at once that two types of chassis have been standardized for 1920. The first is termed the 25 h. p. and has a four-cylinder 95×140 mm. engine ($3\frac{3}{4} \times 5\frac{1}{2}$ in.), while the other is termed the 30-98 h.p., having four cylinders, 98×150 mm. ($3\frac{1}{2} \times 5\frac{1}{8}$ in.). Both models have their four cylinders cast in a block with side valves, the cylinder casting being bolted to the top half of the aluminum crankcase and surmounted by an overall aluminum water riser.



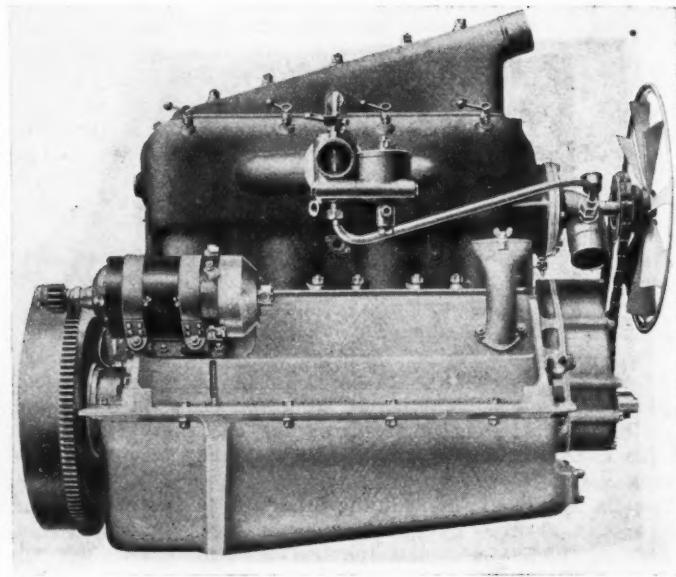
20-25 H.P. Straker-Squire engine, magneto side



20-25 H.P. Straker-Squire engine, carburetor side



25 H.P. Vauxhall engine, magneto side



25 H.P. Vauxhall engine, carburetor side

Both are similar in regard to general arrangement, the outstanding characteristic of the larger type being the fact that it is designed as a high-speed sporting model, intended to develop and maintain high powers at high engine speeds. With this object in view, it has quick lift and high lift cams, enabling it to run to over 3,000 r. p. m. without impairing charging efficiency. It is claimed that the special cam design enables valve springs to be used of a strength that with an ordinary cam would be effective only up to 2,000 r. p. m.

In regard to details of the design, the 25 h. p. model has magneto ignition and forced lubrication through the hollow crankshaft, the oil pump being of the plunger type. Two special features have to do with the lubrication system, the first being the fitting of a filter tray covering the whole of the sump and capable of being withdrawn from the front end of the crank case after the removal of four nuts, no oil being lost in the process. The second feature consists of a "sludge trap" located at the lowest point of the sump, wherein is collected any foreign matter in the oil during the course of running. When the capped bottom of this trap is removed, a mushroom type valve is drawn down on to a seat by a light helical spring and remains closed, preventing loss of oil while the sludge is cleaned from the cap. Refitting the latter lifts the valve and opens the traps to the sump.

The carburetor is mounted on a branched inlet manifold on the right side of the cylinder block, passages being formed across the casting to the inlet ports on the left, the exhaust manifold being a separate ribbed casting.

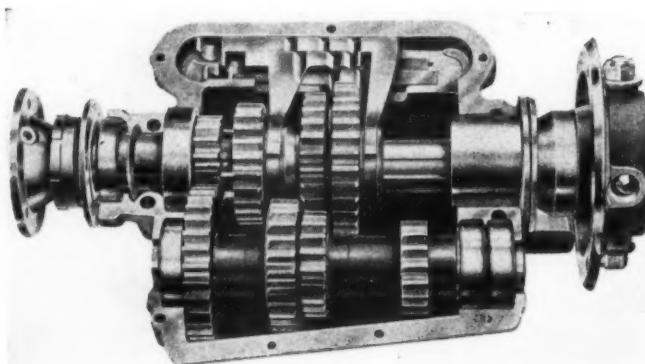
Water circulation is maintained by a belt-driven pump

located at the rear end of the fan shaft in a housing, half of which consists of an extension of the cylinder jackets, the other half forming the water elbow of the riser leading from the bottom of the radiator. This arrangement, which provides an "assisted thermo-syphon" system of water circulation, was originally introduced by the Vauxhall Co. and has been largely adopted in a modified form by other manufacturers.

The engine has four point supports on a sub-frame running from the front cross member to a central cross member of the frame, the gear box being mounted as a separate unit with the drive from the engine conveyed by a cone clutch and flexible coupling shaft. The gear set provides four speeds and has its shafts mounted on ball bearings, the driven shaft being coupled to the open propeller shaft by a star type joint, the driving member of which is formed in one piece with a flange to which is bolted the drum of an internal expanding brake.

The rear end of the propeller shaft has a sliding pot joint, and the final drive is through helical bevel gearing on a spur gear differential. The rear axle is of the full floating type with ball bearings at all points. A pressed steel torque member is used, slung at the front end from the tubular cross member of the frame, although the drive is taken by the front half of the semi-elliptic rear springs. Internal expanding brakes are fitted to the rear wheels, which are operated by a side lever, the gears also being controlled by a lever on the right of the driver.

The wheel base of this model is 130 in., the track being 56 in. while the weight of the chassis complete with electric starting installation is 2,550 lb. The 30-98 h.p. chassis, despite its larger engine, weighs only 2,450 lb., the lower weight being due to the shorter wheelbase, 114 in. The prices at which the two chassis are sold are respectively £975 (approximately \$4,150) and £1125 (approximately \$4,800), with lighting and starting equipment.

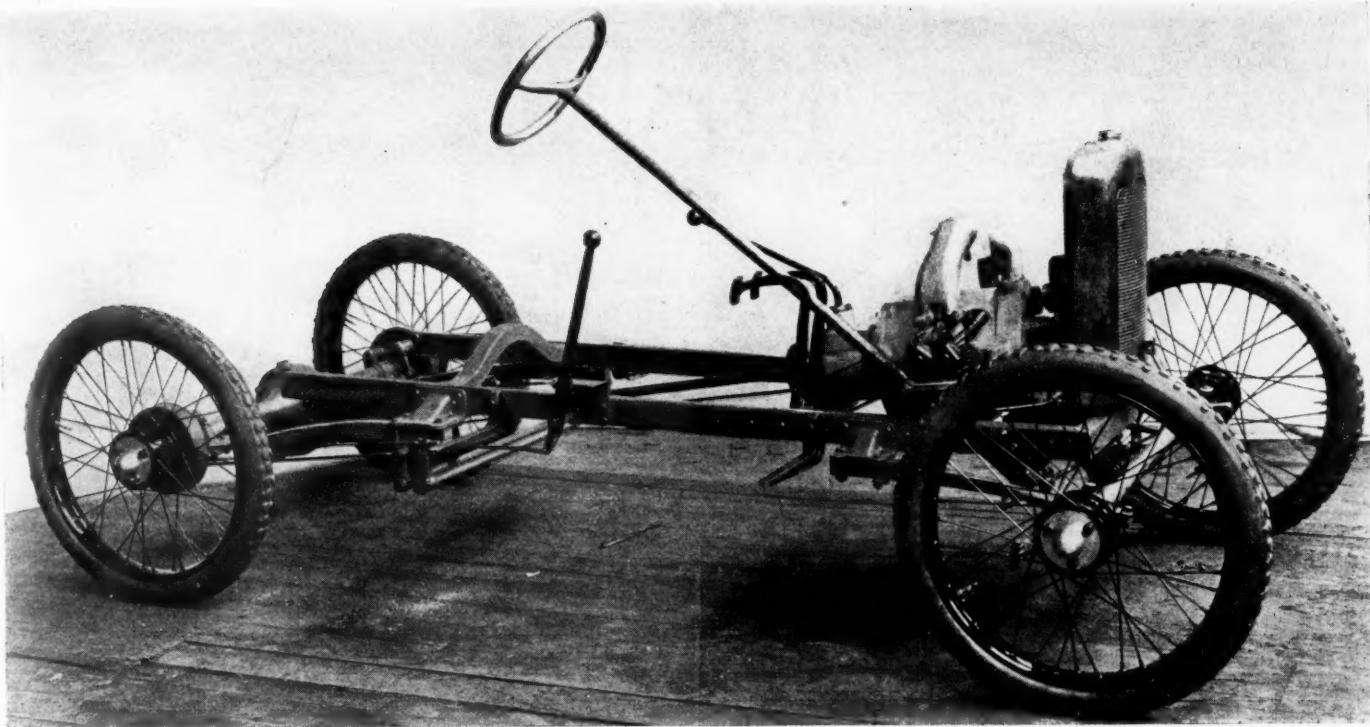


25 H.P. Vauxhall, four-speed gearbox

The Two Rovers

The Rover Co., Coventry, whose 12 h.p. car attained very wide popularity prior to the war, has decided upon two models for 1920. The 12 h.p. type is being continued in modified form, and, like the pre-war chassis, has a four-cylinder engine of 2.9x3.1 in. bore and stroke.

The new engine, although it has the same dimensions as the old one, develops 15 per cent greater power, this improvement being obtained by the use of larger diameter valves and larger



Chassis of new 8 H.P. Rover car

inlet passages. In place of integral exhaust passages a separate manifold is now used, while the removal of "hot spots" from the head casting has eliminated an undoubtedly failing in the pre-war Rovers, namely, "pinking" due to pre-ignition when the engine was slightly carbonized. The water circulation now includes an accelerator driven from the fan shaft, the housing of same also serving as the elbow of the water uptake.

The crankshaft is carried on three white metal bearings in the upper half of the crank-case, and has two sprockets for silent chain drives at the front end. One chain serves for the cam shaft and another for the magneto. On the driving shaft of the latter are two belt pulleys, one for the dynamo, which is mounted on a bracket over the magneto, and the other for the fan and water accelerator. A two-unit lighting and starting system is used, the starting motor driving through a toothed ring on the flywheel as usual.

A simple trough system of lubrication is used, the gear type pump being employed, from which a special lead is taken to deliver oil to the distribution case. Galleries are formed over the crankshaft journals to collect oil for these bearings.

H-section connecting rods are fitted with phosphor bronze bushes for the piston pins. The latter are held in the cast iron piston, which is freely bored to reduce weight, by means of a special ring encircling the piston at the centre line of the bosses.

A single disk type of clutch is used, with a flexible disk joint between it and the three speed gearset. The latter has a feature of interest, in that the constant mesh wheels are located within a separate compartment at the front end, the driving shaft unit being supported at each side on ballbearings, while the driven wheel overhangs from the plain bearing at that end of the layshaft.

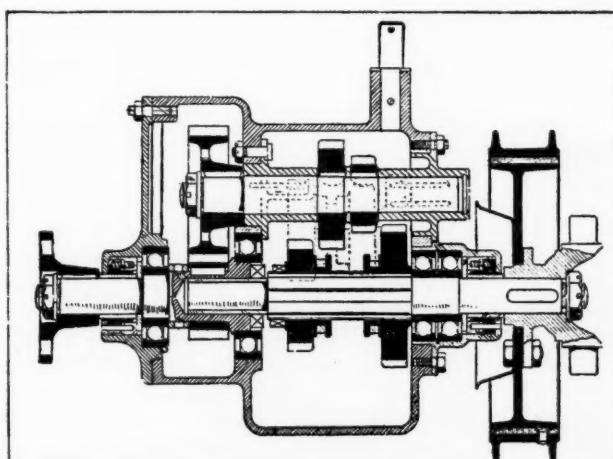
An open propeller shaft, with a sliding pot joint at the rear, conveys the drive to a straight worm under the rear axle, which is of the semi-floating type with ball bearings. The springs are relieved from torque stresses by a tubular member running from the centre of the axle casing to an anchorage depending from a cross member of the frame. The front halves of the semi-elliptic rear springs are, however, utilized as radius members.

At the beginning of October last, the Rover company had

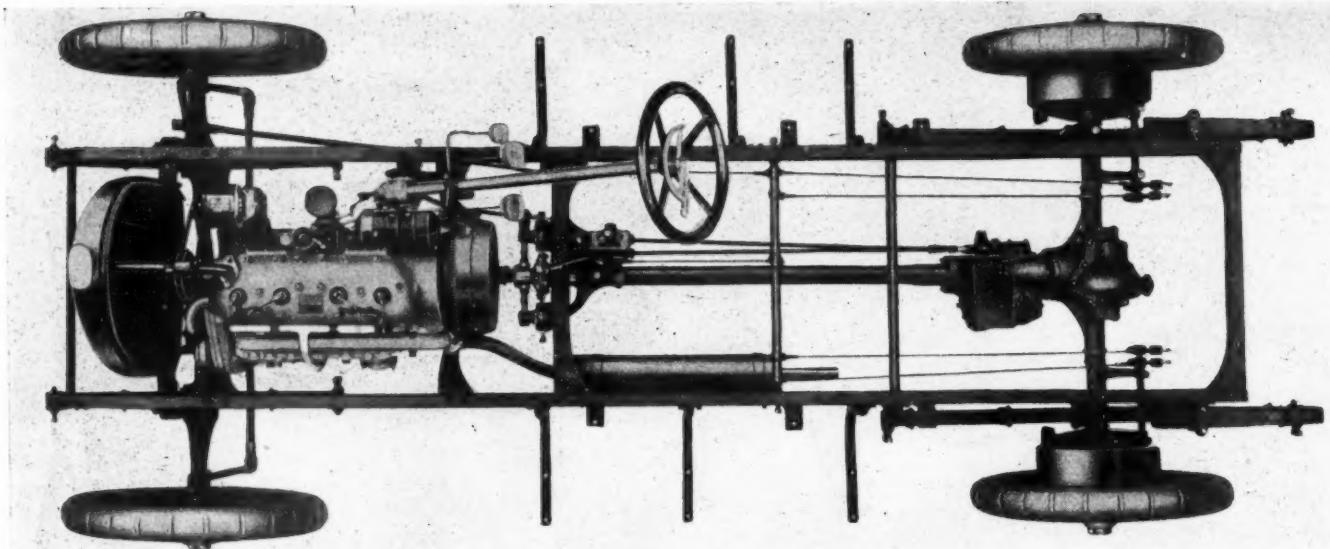
reached an output of between 25 and 30 of these cars per week, but had retained its pre-war type of horizontal straight-sided hood and "step-up" cowl dash. For 1920, however, a slightly tapered hood has been adopted with a sloping cowl leading up to the support for the single panel screen. The cars delivered until the beginning of November had gravity fuel feed from a dashboard tank, but the new type has a tank at the rear and vacuum feed to the carburetor,

The chassis is sold with a four-five passenger body, electrical equipment, spare wheel and tire, Klaxon horn, clock and speedometer at £750.

The second Rover model is a light two-seater with an air-cooled 8 h.p. engine, having two horizontally opposed cylinders of 3.3x3.4 in.; the combustion chambers project at each side of the hood, where they lie in the V between mudguard valance and hood panel, catching the air draughts which merge at that point. This is a runabout which will sell at £230, with a single disk clutch, three speeds, worm drive, cantilever springs at the rear and quarter-elliptics in front. A 6-volt dynamo lighting set is provided.



Section of the new Rover gearbox showing the arrangement of the constant mesh wheels in a separate front compartment



The Ruston Hornsby

The Ruston Hornsby

One of the big engineering firms in England which has turned to automobile production to enable them to utilize to advantage their largely increased factory space is Ruston & Hornsby, Ltd., whose chief plant is at Lincoln. This company, representing a combination of three well-known British engineering concerns, has an authorized capital of approximately \$12,000,000.

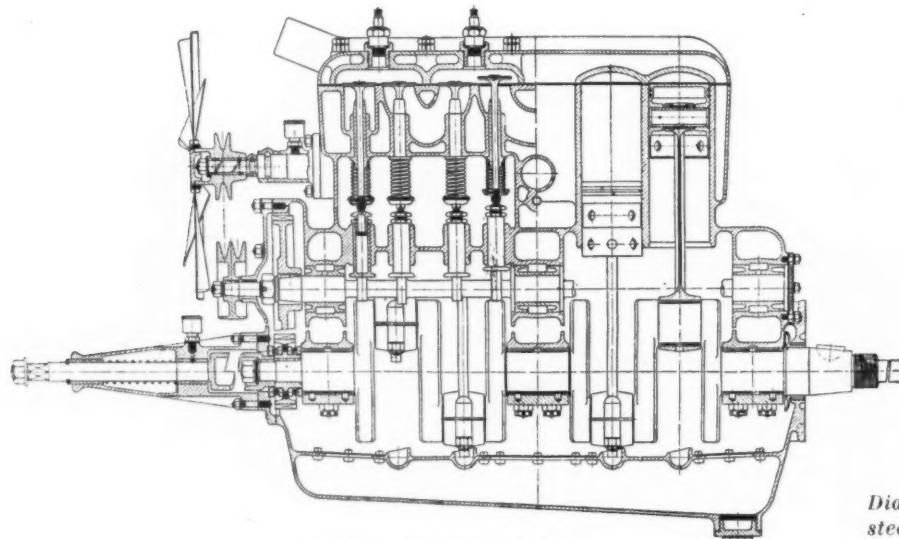
It is the intention to produce next year some 6,000 cars. Although the price now quoted for the complete five-passenger model (£600—say \$2,600) will hardly allow it to compete in the low-priced car market, the resources of the makers should allow them to reduce this price considerably when they get into their stride.

The chassis contains no novel features of design, if the mounting of the gear set on the back axle and a cam type of steering gear are excepted. The four-cylinder block engine is three-point suspended, the front being supported by a spherical trunnion bearing on the front cross member of the frame, while at the back two brackets connect the side frame members with arms of the crank case. The $3\frac{1}{2} \times 5\frac{1}{2}$ in. block casting, which has a detachable head, consists of cylinders and upper half of the crank case. A counter-weighted crankshaft is used, supported by three die cast metal bearings and having a double

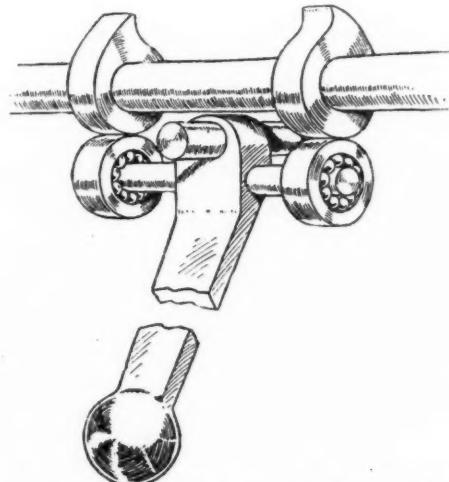
ball thrust bearing at the front end; the connecting rods are H section stampings and connect to the light cast-iron two-ring pistons through hollow wrist pins, the latter being free to oscillate in the piston bosses or in the bushes of the small ends.

Silent chain distribution is embodied, a single chain serving for both camshaft and a lay shaft on the left which drives the water pump in front of the distribution case and the magneto behind. The latter unit is of the flange fixed type, being supported by a cylindrical extension of the timing case, which encloses a sliding coupling. The camshaft also has three bearings, the cams operating the valves by mushroom ended adjustable tappets.

Lubrication is maintained by means of a gear pump in the sump. Oil leads are carried to the main crankshaft bearings, but the shaft itself is not drilled for forced lubrication. A separate oil lead is carried to the chain of the distribution gear, while a prominent feature on the left of the crank case is a very large, easily removable oil filter bearing a cover plate plainly marked "Oil filter. Clean often." Between the bottom of the two central cylinders a transverse passage is formed to convey the mixture from a horizontal type Zenith carburetor on the right to a Y-branched inlet pipe on the left. The exhaust manifold is a separate casting, also on the left. Fuel feed is by gravity from a 10 gal. tank carried in the pressed steel cowl dash. A two-unit electric system is used.



The Ruston Hornsby engine



Diagrammatic sketch of the Ruston Hornsby cam steering gear. In practice the cams are keyed to the steering wheel column

An inverted type cone clutch is used, and consists of two light steel pressings, the outer member bolted to the flywheel and the inner one carrying a fabric facing. Pressure is applied from within by a single volute spring, the tension of which can be varied by means of a split nut and thrust collar outside the clutch centre. Attached to a point near the front end of the propeller shaft casing are the gate and lever of the change speed mechanism, from which adjustable selector tubes run back alongside the propeller shaft casing to the three-speed gear-set mounted on the flanged rear end. The casing of the gear set is a unit separate from both shaft casing and back axle centre, being flanged at each end and bolted between the other units. The lay shaft is alongside the driving and driven shafts and provision is made for driving a speedometer by arranging an extra pinion supported in the cover of the box and driven from one of the pinions on the lay shaft.

The back axle is of the semi-floating type, with straight toothed bevels for the final drive. Axle center and extension tubes consist of a single casting, above the center being a large overall cover plate, through which the differential and driving gears can be introduced or inspected.

The steering gear is a peculiar design and differs from the ordinary in that the movement of the lever shaft is obtained through the action of two cams. These are of the small pattern, keyed to the steering column, so that the rotation of the steering wheel increases the lift and angle of one cam and acts in the opposite way as regards the other. The outer peripheries of the cams are in constant contact with two ball races secured to the T head of the steering lever; thus the latter is moved in one direction or the other as the steering column is rotated and the cams take effect.

The standard five-passenger body has sliding and adjustable front seats, a flush-fitted instrument board and a top which folds back into a compartment surrounding the rear seat.

The Swift

The old established Coventry firm of the Swift Motor Co. will specialize upon one model having a four-cylinder 2.7x5.1 in. block; ten to fifteen cars per week will probably be the limit of output in 1920. The engine has side valves on the left, with a separate exhaust manifold. The Zenith carburetor is bolted to the right of the casting with a passage formed across the block to the inlet ports. Crankshaft lubrication is by force feed from a gear type pump driven from the camshaft. Two

silent chains are used for the distribution, an idler sprocket being mounted on a slotted bracket, for adjusting the camshaft chain, while the subsidiary chain to the magneto shaft is adjustable by means of a right and left-hand threaded stretcher, the magneto shaft bearing being carried in a slotted flange plate. The crankcase is of aluminum, and has a large aluminum sump.

Both engine and transmission have a four-point support on the main frame, the latter being bolted to an extended lower web of each frame side member. A flexible disc joint occurs between the two units. Four speeds are provided, with the gear lever on the right side of the driver. The box is of aluminum, a one-piece casting into which the shafts are introduced from the rear end.

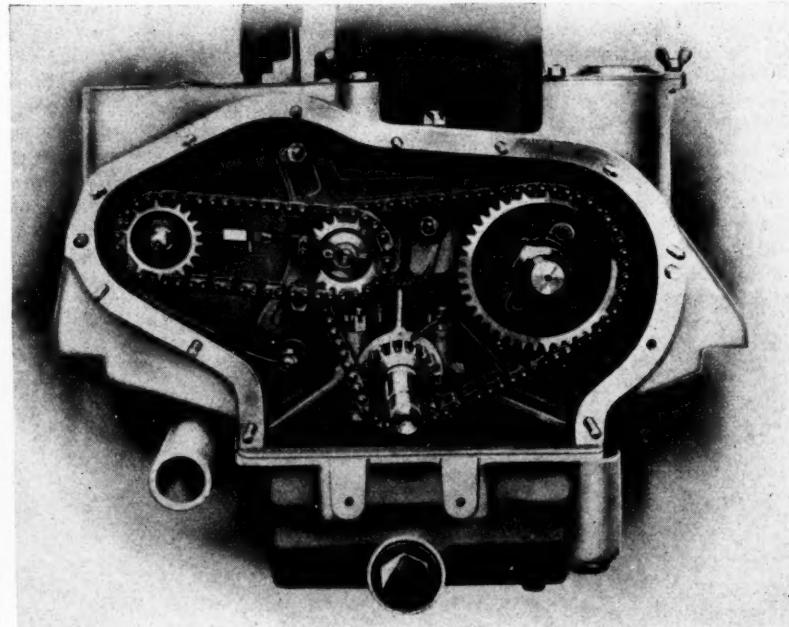
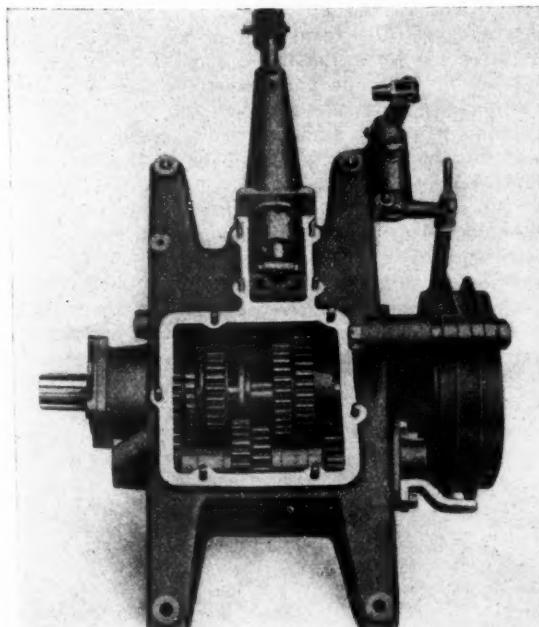
Bevel gearing with a ratio of 4.26 to 1 forms the final transmission in the back axle, the latter consisting of a cast steel center with tapered steel sleeves on which the wheels run in ball-bearings. The front end of the semi-elliptic springs form radius members and take the thrust of the drive, the torque being taken by a pressed steel member anchored at its front end to the central cross member of the frame.

A feature of note is the provision of special abutments for the head of a lifting jack at either end of each axle. With a full electrical equipment and a four-seater body, the weight of this car is approximately 2,000 lb., the chassis having a wheel base of 108 in. and a track of 48 in. It is a type of car which is in great demand in England at the present time, representing a comfortable and economical four-passenger outfit.

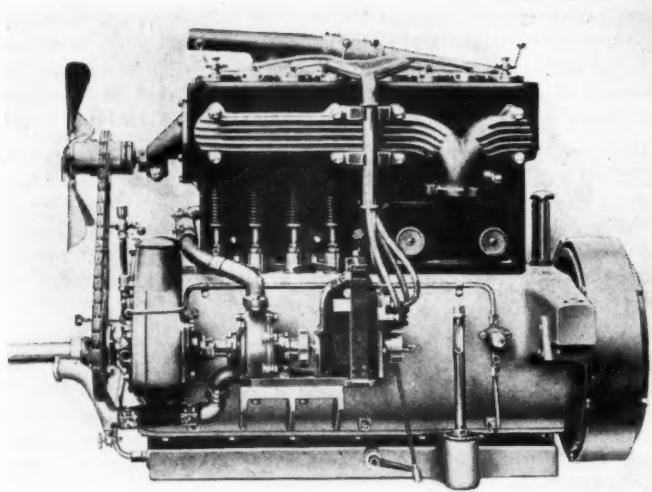
The 11 H. P. Bean

During the war the important British engineering firm of Harper Sons, & Bean, whose principal plant is at Dudley, between Birmingham and Wolverhampton, built an extensive additional factory for shell production and had one of the largest outposts of artillery ammunition among private firms in Great Britain. The company also owns one of the largest stamping works in England, and has for many years supplied most of the British motor manufacturers with parts in the rough.

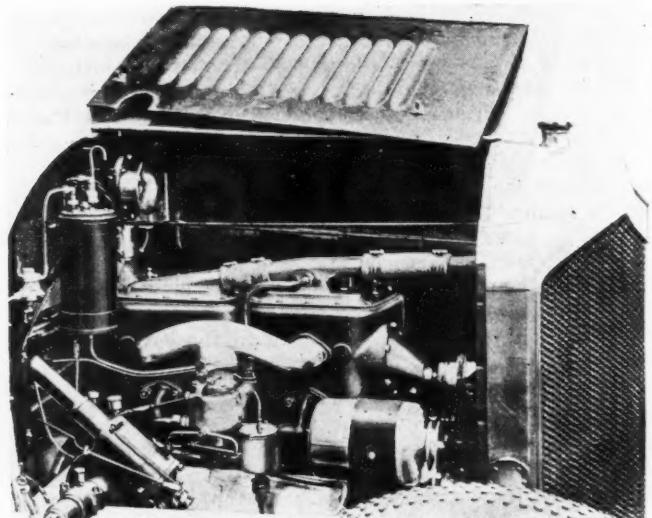
To utilize the shell factory, the production of automobiles was decided upon, and during the organization of the plant, an 11 h.p. car is being produced. But it is the intention to reach an output at the rate of 10,000 cars yearly within the next 12 months, and the type that will be standardized is not necessarily that now being made.



Construction details of the Swift



Exhaust side of Crossley engine



Side view of Crossley engine showing Autovac petrol feed tank, electric horn and dynamo

The R. F. C. Crossley

The British Royal Flying Corps made very extensive use in all parts of the world of the 25-30 h.p. four-cylinder Crossley chassis. It was used both for passenger carrying with a five-seated body and as a light covered truck for one-ton loads. The factory at Gorton near Manchester was kept occupied during the war producing this one model for the Flying Corps, and as the chassis now being manufactured follows the same general lines it is termed the R.F.C. type.

It has a four-cylinder 4x5 in. engine, the cylinders being cast in a block and bolted to the aluminum crank case. The latter is of the barrel type and has bolted to it a flat-bottomed oil sump. The five bearing crankshaft is threaded through a large opening at the rear end of the crank case, the bearing caps being bolted up from below. The camshaft is driven by a silent chain and also has five bearings; its axis is offset in relation to the roller-ended tappets, the center line being outside the vertical axis of the valves. This arrangement, it is claimed, enables steeper (quicker lift) cams to be used without detracting from the normal quietness of operation.

Pressure lubrication is used for the crankshaft journals and big ends, and splash for other parts.

Cast iron pistons are used, each with three rings in the head, and a hollow, floating wristpin secured from end movement in the bosses by a bolt passing through it from one side to the other, the head of the bolt and the nut tightening up against a washer at each end. The piston is counter-bored at each side, and the washers abut shoulders formed at the beginning of the smaller diameter. To prevent piston slap, one side of the piston is connected to the coupling rod, just below the small end, by a pair of springs, which tend always to pull the skirt of the piston toward the rod on that side.

Pump water circulation and magneto ignition are used, the two units being arranged in tandem on the left of the crank-

case, driven by the same chain that serves for the camshaft. This chain is made adjustable by mounting the pump and magneto sprocket shaft in bearings in slotted flange plates, in front and back of the distribution casing. To preserve the alignment of their shafts both pump and magneto are mounted on a single base plate secured to a bracket by bolts passing through slotted holes.

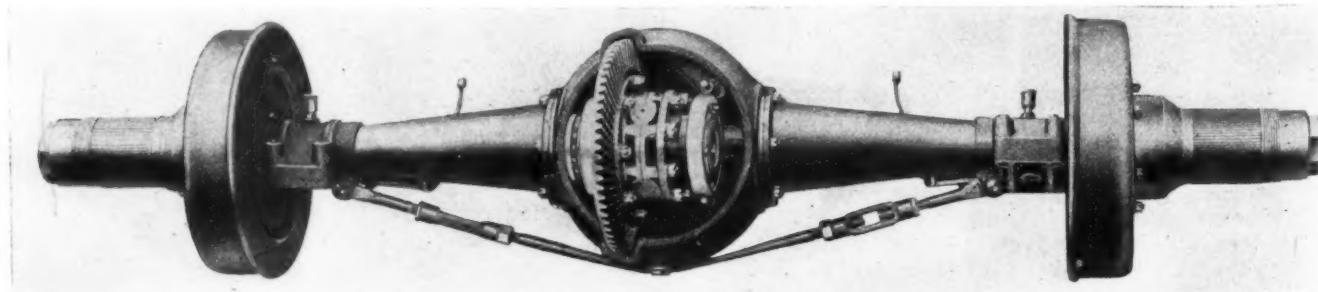
The carbureter, a four-jet type with a fifth jet for starting and a water jacketed mixing chamber, is bolted to a manifold on the right side of the cylinder block, two passages through the latter leading between the front and back pairs of cylinders to the valve ports on the right.

A cone clutch with a fabric facing conveys the drive through a coupling shaft with flexible disk joints to the four-speed gear-set, which is supported by two tubular cross members of the main frame. The gear lever, on the right, has its shaft running through the front tubular support, a peculiar arrangement which, it is claimed, overcomes any liability for the shaft to bind in its bearings owing to frame distortion. The gear shafts run on ball bearings, and the casing, besides having an overall cover plate, has another large plate on the right side, which carries the elbow for oil replenishment.

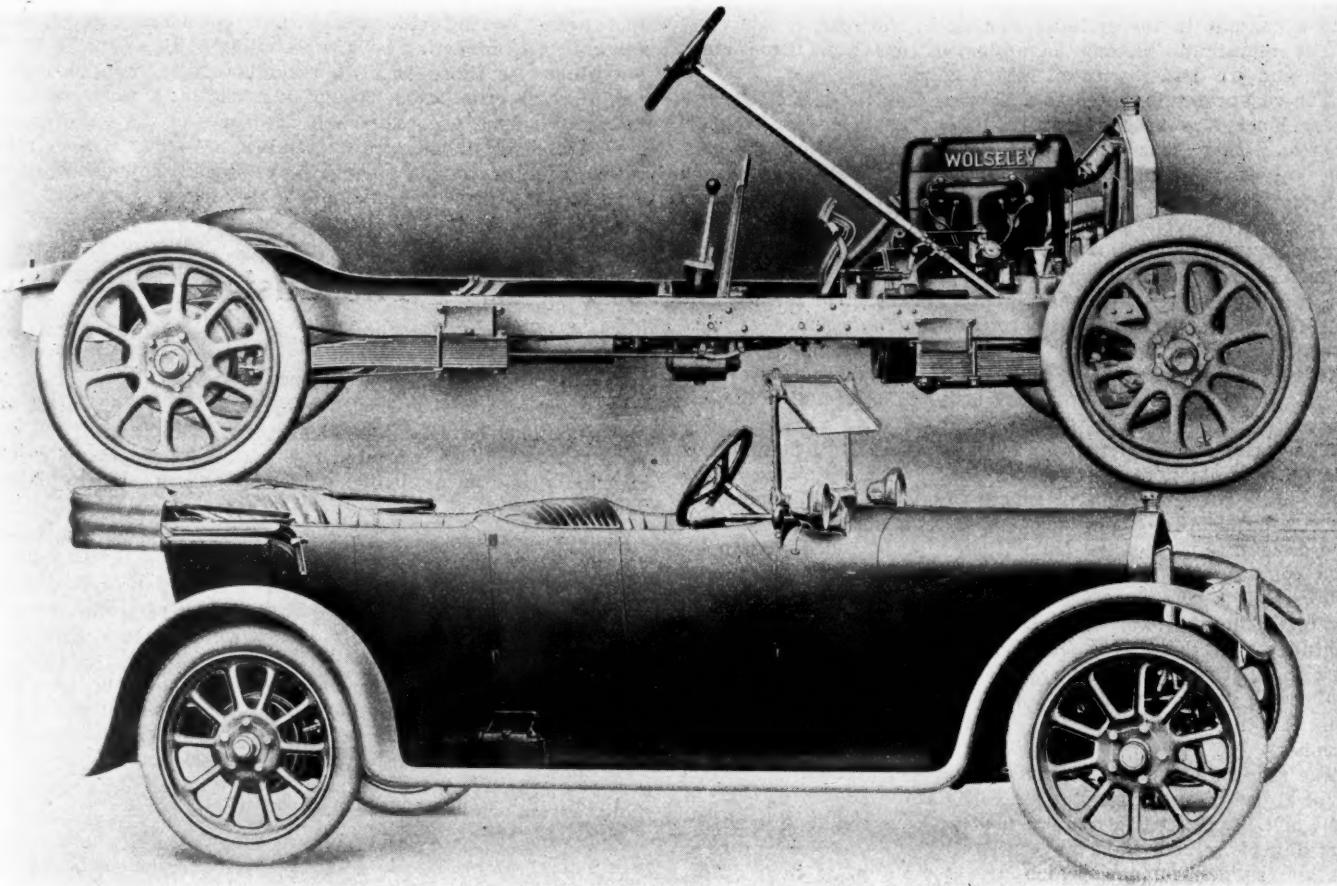
On the rear end of the driven gear shaft is an internal type brake with its drum flanged for cooling and embraced by a bracket which supports the front end of the propeller shaft casing. The latter has an adjustable spherical bearing in the bracket and takes both torque and drive, the axle unit being stiffened by adjustable rods running from the head of the propeller shaft casing to points adjacent to the spring pads.

The drum of the shaft brake has attached to it a belt pulley for a speedometer drive and the front half of a star type universal joint. Steel castings, the center piece spherical and the extensions tapered, form the back axle casing, with an adjustable tie rod underneath; a full floating type with ball bearings has been adopted with straight toothed bevels for the final drive.

A peculiarity is evident in the steering gear of the worm and



Differential and crown wheel partly removed



Chassis of new Wolseley Fifteen. The new 15 H.P. Chassis which has overhead valves and camshaft, a bore and stroke of $3\frac{1}{8} \times 5\frac{1}{8}$ in. coil and battery ignition quarter elliptic springs and worm drive

full wheel type, in that both units are of case-hardened nickel steel. Adjustment of the mesh is provided for by mounting the worm wheel shaft in eccentric bushes.

Rudge-Whitworth triple-spoked wire wheels are standard, but instead of front and back having tires of the same size, the backs are $36 \times 5\frac{1}{4}$ in. and the fronts $37 \times 4\frac{3}{4}$ in. A peculiarity of the frame design is that while the side members are of pressed steel, all the cross members are tubular, the rearmost having diagonal tubular struts.

The range of standard bodies consists of a five-passenger open type, a limousine-landauet, a four-seat coupé, and an all-enclosed 7-passenger saloon. The chassis is sold at £950, while with the open type body the price is £1,200.

Three Wolseley Chassis

The Wolseley Co. has decided upon three types of chassis for next year, these being a 10 h.p. and 15 h.p., both with four cylinders, and a 20 h.p. with six cylinders. Although a yearly output of 20,000 cars is planned, this rate will not be reached during 1920. The smallest model is intended for light two and three seated bodies and has an overhead valve engine with overhead camshaft and a bore and stroke of $2\frac{9}{16} \times 3\frac{3}{4}$ in. Like the other models, it has a final drive by worm gearing. It differs in that the gearset is combined with the back axle.

The most interesting chassis is undoubtedly the new 15 h.p., which, in its general idea, exhibits a striking divergence from previous Wolseley practice. Pre-war Wolseley cars were certainly not noted for their high power-to-weight ratio, but in the new 15 h.p. this desirable feature has been one of the underlying ideas in the chassis design. Its engine has four $3\frac{1}{8} \times 5\frac{1}{8}$ in. cylinders cast in a block, with a detachable head carrying the overhead camshaft and valves.

Aluminum pistons are used, and a three-bearing crankshaft. In this model, as in the smaller one, battery and coil ignition have displaced the magneto, and in deciding upon this form of ignition, the Wolseley company has made itself the only well-known firm of British motor manufacturers to adopt this course. The water circulation is maintained by a pump and lubrication is by the trough system.

Among the details of the engine some interesting and unusual items of design are apparent. In the first place, the cylinder block, with a detachable head carrying the valves and valve gear, is of cast iron bolted to the upper half of the aluminum crankcase. The primary element of the drive to the overhead camshaft consists of a silent chain, which drives the dynamo and ignition distributor shaft on the left and also a layshaft carrying at its forward end of the fan pulley, and at its center the smaller unit of a 2 to 1 bevel gear for the vertical drive shaft, which has another bevel pinion at its upper end engaging with one on the camshaft. The two end portions of the vertical shaft are coupled together by a single plate of spring steel, which, it is claimed, by giving a small amount of torsional flexibility to the drive, insures quieter operation of the overhead valves. The lower end of the bevel shaft carries the driving pinion of a gear type oil pump.

The camshaft itself is supported in three bearings in the detachable head, which also carries two longitudinal shafts bearing the rocking levers through which the valves are actuated. The latter are inclined at a slight angle in the head, in which they have their seats.

Crankcase lubrication is by the trough system, with separate leads from the pump to ports formed over the three main bearings of the crankshaft, and also to the overhead valve gear. The bearings of the camshaft are fed directly by pressure, while oil leads extend to the insides of the hollow rocker pivots; surplus lubricant finds its way back to the crank cham-

ber through the casing of the vertical shaft at the front end and a passage in the cylinder casting at the rear.

The aluminum pistons have domed tops and three rings each, and are drilled with oil return holes.

The carbureter is bolted to a Y branch on the left of the cylinder block, the inlet valves being on that side and the exhausts, with a separate, ribbed outlet manifold, on the left. The valves, it should be noted, are slightly staggered in the cylinder head. An S. U. type of carbureter is used, modified to accord with Wolseley ideas. A slow-running and starting jet provides a very rich mixture and is cut out as the throttle is opened and suction takes effect upon an air piston with a tapered needle extension passing into the main jet orifice. At full throttle, a cam on the throttle spindle actuates another needle valve and opens up an additional fuel supply. It is said that a consumption of 30 m.p.g. (Imperial measure) has been attained with a four-seated body, and that 25 m.p.g. is normal.

The battery and coil ignition system is a B. L. I. C., made by another subsidiary of the Vickers firm. The clutch is of the multi-plate pattern, running in oil. Between clutch and gear-set, the latter three point suspended as a separate unit from two cross members of the frame, one tubular and one channel, is a coupling shaft with flexible disk and sliding pot joints. Three speeds are provided with right-hand gear and brake levers. Timken roller bearings are used throughout the box, behind which there is a short coupling shaft with a flexible disk joint at the front end and a sliding pot joint at the rear, connecting it to the enclosed propeller shaft. The spherical head of the torque tube is supported by a channel cross member.

The rear axle has an aluminum center and tapered extensions of steel tube, and contains an under-mounted worm with a ratio of 4.7 to 1. It is of the non-floating type, the driving shafts carrying the wheel hubs on castellated ends and running in Timken roller bearings, which are also used for both differential casing and worm shaft.

Both brakes apply to the rear wheel drums, but a feature of note is that in each drum there are two pairs of shoes the full width of the drum, each pair occupying rather less than a quarter of the internal circumference and expanding at right angles to the other pair.

An unusual form of suspension for a chassis of this size is used, comprising quarter elliptic springs, both front and rear. This system appeared in the pre-war 10 h.p. model, which was generally recognized as the best sprung light car on the British market.

Weighing but 1700 lb., with a wheelbase, 118 in. and a track of 52 in., this chassis will appeal to a large public, in view of the reputation of its makers for high-grade work, added to the high power-to-weight ratio evident as compared with pre-war Wolseleys.

The six-cylinder model is of quite a different type, its 3½x5½ in. engine having side valves and cylinders cast in pairs. Pistons and connecting rods are similar to those in the 15 h.p., but otherwise there is little resemblance. Magneto ignition, pump water circulation, trough lubrication, a four-speed gear-set and an open propeller shaft are some of the features, with a separate ball-ended torque member. Worm drive (4.1 to 1 ratio) and cantilever springs have been adopted, while the chassis generally is designed for luxurious bodywork. The wheelbase is 138 in. and the track 54 in.

The Ensign

The ensign is a newcomer but has behind it individuals well-known in engineering circles in England. The six cylinders, 102x140 mm. (4x5½ in.) are farmed in pairs of cast aluminum jackets and pressed-in cast iron liners. The detachable one-piece cylinder head is also in cast-iron, and carries the overhead valves operated through rocking levers from an overhead camshaft, the latter being driven by worm gearing and a vertical shaft.

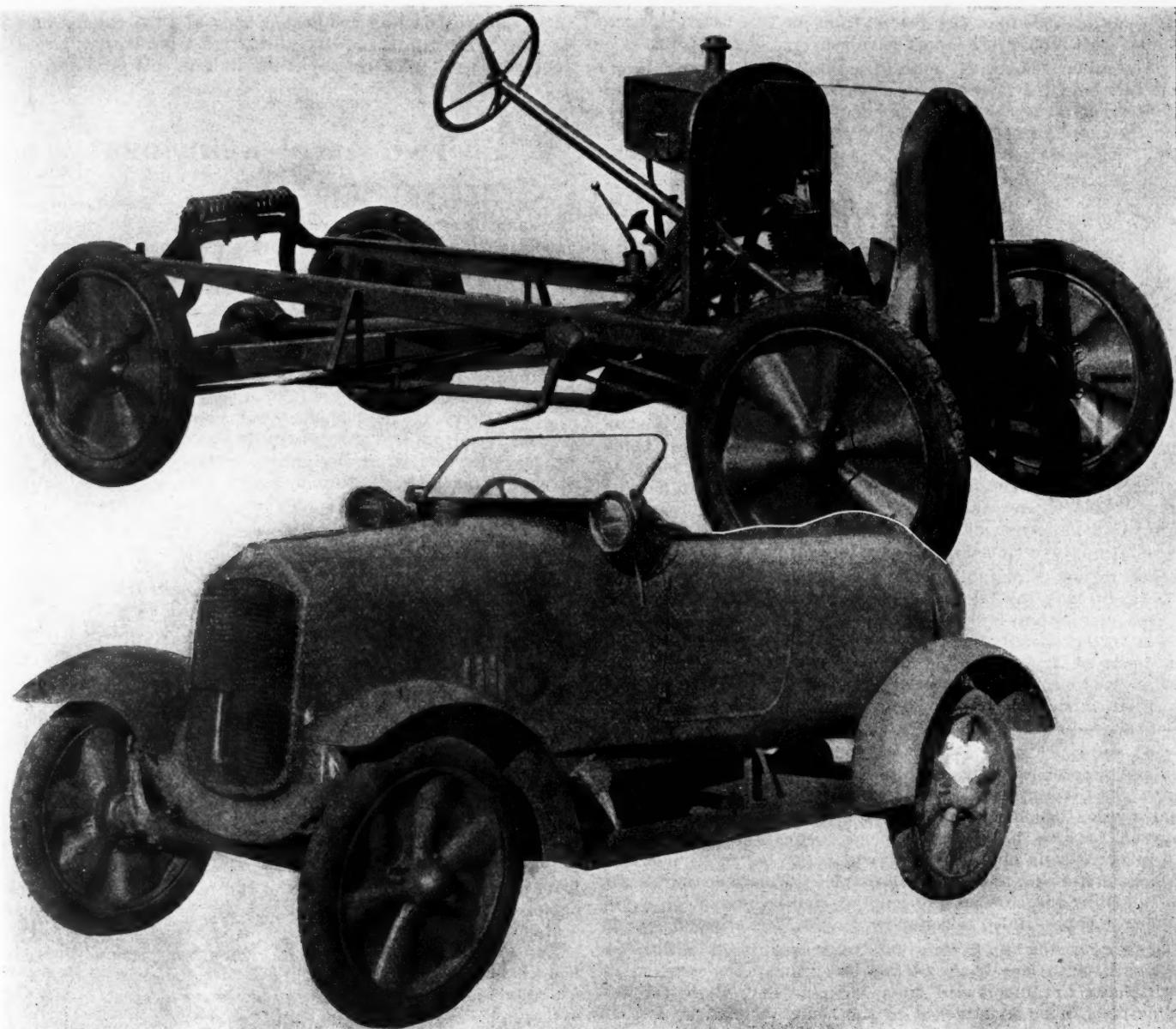
Separate exhaust and inlet manifolds are used, the former on the left and the latter on the right. The inlet manifold, however, is divided internally by a central web and each half takes its mixture from one side or the other of a duplex Zenith carbureter. The inlet manifold as a whole is also water jacketed, being in direct communication with the water spaces in the cylinder head. The four-bearing crankshaft is drilled for forced lubrication. Hour-glass shaped aluminum pistons are used, and to reduce weight and improve balance the connecting rods are machined all over. An unusual feature lies behind the gear-box, which provides three speeds and has its hollow shafts mounted on ball bearings.

From the driven shaft, a short coupling shaft with a universal joint at each end is arranged, the rearmost of the two joints forming the propeller shaft universal enclosed in a spherical housing, which constitutes the head of the shaft casing and is supported by a special cross member of the frame. It is difficult to realize the advantages of this system, for an extra universal joint is needed and the angularity of the propeller shaft is obviously increased by shortening it. Helical bevel gears form the final transmission, located in the aluminum center of the back axle casing, the extensions of the latter being of pressed steel.

Cantilever springs have been adopted for the rear suspension, with semi-elliptics at the front. This is one of the very few British cars, if not the only one, that will be fitted as standard with detachable wheels and detachable rims, the last-named being of the Warland contractible type. Two spare rims will be included in the equipment, the tire size being 880x120 mm. (approx. 35x4¾ in.).



British Ensign five seater



(Above) The Cosmos (C. A. R.) 3 cyl. aircooled chassis. Note dummy radiator and corrugated single disk wheels
 (Below) The Cosmos C. A. R. three cylinder air cooled radial engined chassis with cloverleaf body

Cosmos, Three-Cylinder Radial Engine

One of the most interesting small cars of British manufacture for 1920 is the three-cylinder air-cooled Cosmos. It is to be called the C. A. R. (Cosmos Air-cooled Radial) and is the product of the Cosmos Engineering Co., Bristol and London, the concern that prior to the war made the Straker Squire car on contract. During the war the Cosmos plant was devoted solely to the production of radial-cylindered airplane engines, the latter still constituting the principal output.

The new light car is rated at 10 h.p. and has its three air-cooled cylinders (80x80 mm., approximately 3½x3½ in.) set radially and equally spaced around the aluminum crank case. The barrels are of cast iron and have separate heads with cast-in steel valve seats. A built-up single throw crankshaft is used, the junction of the halves being made at the pin; the shaft runs on ball bearings and has integral balance weights. The three drop-forged connecting rods of H section are not split at the big ends, but each carries the outer race of a roller bearing; the inner races and spacing washers are threaded on to the crank pin during assembly. The aluminum die-cast

pistons have two rings below the head. Piston pins float in the rod and the piston bosses, the latter being plugged by brass buttons to prevent lateral movement of the pin. Helical gearing is used for the distribution, the camshaft being located in front of the engine and operating the overhead valve through push rods and rockers.

The crank case, with the cylinders set as an inverted Y, has a sump formed below it, oil being lifted therefrom and sprayed by a gear type pump into the crankcase and timing gear-casing, provision being made for preventing the flooding of the lower cylinders when the engine is stationary.

This is one of the very few British cars without a magneto, the ignition being by generator and coil; the former is driven by helical gearing from the crankshaft at one and a half times engine speed and itself drives, also by helical gears, the ignition distributor. Batteries are carried, but for lighting only. To provide a good spark for ignition at starting a "booster" is fitted to the generator. At the front end of the crankshaft is a fan delivering air past the finned cylinders. The carburetor, a Ware, is located on the right of the engine and delivers mixture to a passage formed through the crankcase and leading to exterior radial pipes branching to each cylinder.

To connect engine and gear set the crankcase is extended rearwardly and encloses the flywheel and the single plate

clutch. Three speeds are provided with central lever control; the mainshaft of the gearset runs in ball bearings while the layshaft and reverse shaft have bearings of cast iron.

A peculiar system of helical springs and bellcrank levers has been adopted for the suspension fore and aft, the arrangement being made clear in the accompanying illustration, showing the chassis from the rear.

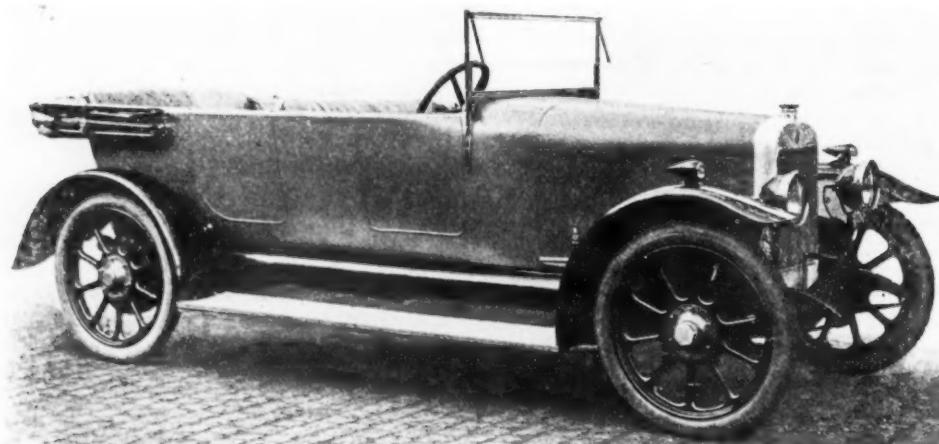
Belsize

The firm making the Belsize cars was one of the earliest of motor manufacturers in England, commencing operations very early in the century with a belt-driven car with a horizontal engine. Immediately prior to the war two models were made, but for 1920 one model only will be made, this being a four-cylinder type with cast-iron block cylinders bolted to the aluminum crankcase, the bore and stroke being 3.54x4.33 in. It is a comparatively slow speed engine, the normal speed of rotation being 1,000 r.p.m. Side valves are used, these being on the left, a Zenith horizontal type carburetor being bolted to a flange on the right of the casting with the mixture passing between the second and third cylinders to the inlet passages formed on the other side of the block. The exhaust manifold is a three branch ribbed unit separately formed in cast iron.

Lubrication is maintained by a gear type pump delivering the oil through the crankshaft to main and big-end bearings. Water circulation is maintained by a pump located at the front of the distribution case, the rearward continuation of the pump shaft forming the magneto drive. The coupling for the magneto consists of two flanged nuts with teeth formed on their inner faces, these teeth being coupled by a rubber block shaped to correspond.

The crankcase is divided horizontally and, while the clutch pit and gearset casings are bolted to it to form a unit, a circular steel forging intervenes, this forging having engine bearer arms bolted to it at each side. The engine and transmission unit is three-point suspended from the main frame. An inverted cone clutch is used, which can be removed entire without disturbing the engine or gearset. This is accomplished by detaching the clutch shaft coupling and removing the outer driving member, which is bolted to the rear face of the flywheel.

The gear casing and flywheel pit are of cast aluminum formed as a unit, with merely an overall cover for the former. The gear shafts are introduced from the rear end, while the selector mechanism is attached to the cover plate, with an extension on the right carrying the gear lever in a boxed-in selector gate. Four speeds are provided, the driven shaft supporting the three-arm star of a flexible disk joint at the front end of the open propeller shaft. The joint star has bolted to it the pulley of the dynamo belt drive, the dynamo being secured to a bracket on the left side frame member. The starting motor takes effect on gear teeth on the flywheel in the usual way.



The Belsize

This chassis has a wheel-base of 116 in. and a track of 52 in. It is sold with a four-five seated body at £590 (approximately \$2,400). This firm is not likely to attain a big output; probably ten chassis per week represent its limit in this direction.

Two Arrol-Johnstons

The Arrol-Johnston Co., the only motor manufacturers in Scotland turning out passenger cars, announced an entirely new model during the early part of this year, but variations have been made since the first specifications were issued, and the chassis is not yet in production. It has been decided recently, however, to put in hand a second type of much the same size, but differing from the first mentioned, which is termed the "Victory" model, in that the later design has side valves, and, as a matter of fact, resembles in many respects the same firm's pre-war chassis.

The Victory model has overhead valves with an overhead camshaft and, although originally it was planned as a 2.95x5.9 in. machine, the latest design has a larger bore and shorter stroke (3.15x5.5 in.). Rumor has it that this model will be produced only in a limited number, the second model, termed the 15.9 h.p., being concentrated upon. The latter also has a four-cylinder block engine, with the same bore as the other (3.15 in.), but a 120 mm. (4.7) stroke. It has a unit system of engine and gearbox mounting in the main frame. Ignition is by magneto, water circulation by thermo-siphon and fuel feed by gravity from a dashboard tank. The clutch is of the single disk type, while the gearset provides four speeds with right-hand control. The enclosed propeller shaft with a star type joint at the front connects to helical bevel gearing, giving a 4 to 1 ratio in the back axle. This is the only car on the British market with full elliptic rear springs, a practice which obtained in the corresponding chassis before the war. With a wheelbase of 120 in. and a 56 in. track, the chassis with a four-seated body, sells at £625 (approximately \$2,625).

Besides overhead valves the Victory chassis differs from the other in that it has a cone type clutch and the engine and gearbox mounted separately in the main frame. It has cantilever rear springs, both these and the front semi-elliptic being enclosed in grease retaining gaiters. This model with a four-seated body is priced at £700 (approximately \$3,000).

Both standard bodies have adjusted front seats, while the body fitted to the 15.9 h.p. chassis also has rear seats which are adjustable as to angle of cushion and back rest. Both cars are equipped with a two-unit lighting set.

IN connection with the use of the emery wheel, considerable expense has always resulted from the necessity of frequent trueing and dressing of the grinding surface; this has been so particularly in recent months, because of the soaring prices of the trueing medium usually employed.

A wheel trueing tool made by the Ross Mfg. Co. is claimed to be an inexpensive substitute for the ordinary type of wheel truer. The Ross tool is designed especially for straight faced wheels, and consists of a cylinder of hardened steel with two series of deep diagonal slots cut at right angles to each other. The size and spacing of the slots are varied according to the character of the work for which the tool is intended.

The bearings are enclosed to prevent grit from entering and are easily adjusted. There is said to be little grinding action on the tool surface, because both surfaces are moving with the same speed. The slight pressure applied loosens the crystals on the surface of the emery wheel and exposes a new surface.

A Rotary Valve Not Moved by Pressure in Cylinder

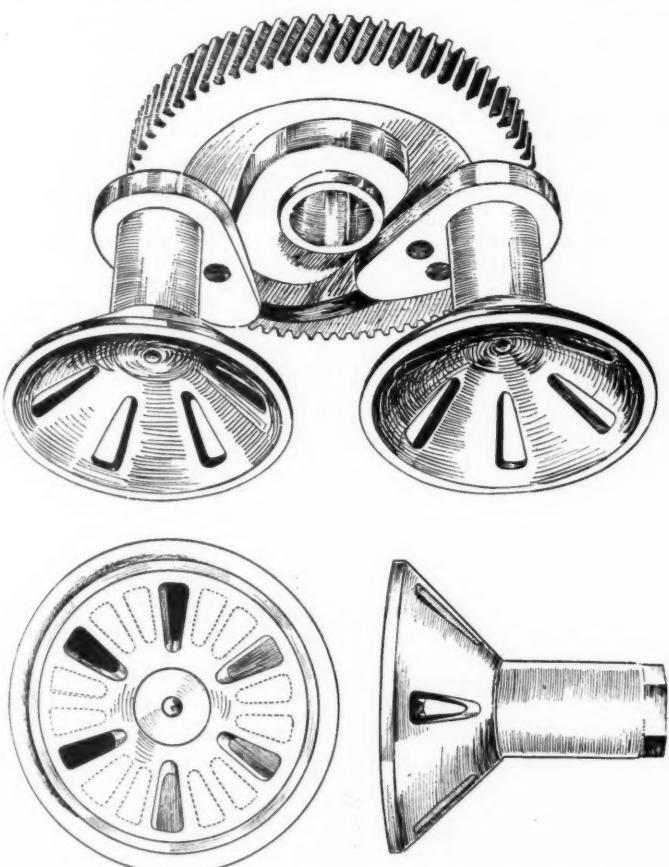
This rotary valve is one of the distinctive features of the Sinclair engine. It receives its motion from a cam disc and begins to move only after the spent gases have been eliminated. The entire action of this engine, described here, is particularly interesting.

ARATHER unusual design of four-cycle engine is being made by the Sinclair Motor Co., Inc. It is a scavenging engine, removing all the spent gas from the combustion chamber during each cycle; it uses the crank chamber as a pump and forces more air into the combustion chamber than could be gotten into it by suction; and it makes use of a special design of silent rotary or rocking valve which moves on its seat only when there is very little pressure in the cylinder.

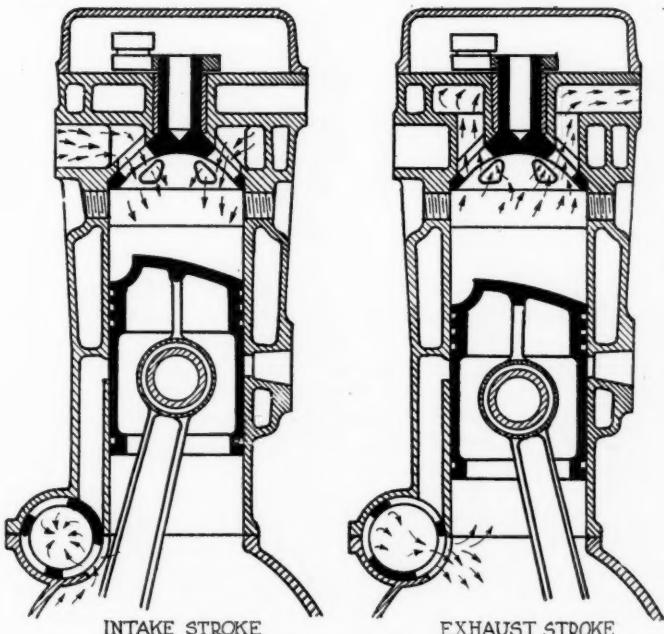
In a four-cylinder engine the crankshaft is supported in five bearings and the crank chamber is evidently divided into four compartments by partition walls. In each crank chamber compartment compression occurs during the downstroke of the corresponding piston, and two compartments compress simultaneously. These two compartments are placed in communication

with the cylinder in which the power stroke is taking place, toward the end of that stroke, through a rotary distributor valve at the side of the crank chamber and a port in the cylinder wall at the bottom of the stroke; this port is uncovered by the piston. Simultaneously an auxiliary exhaust port at the opposite side of the cylinder is uncovered by the piston and the compressed air from the crankcase sweeps the spent gases from the combustion chamber.

There is only one valve in each cylinder, this being a conical rotary valve located in the cylinder head. This valve is cut with six ports, equally distributed over the circle, of which three serve for the inlet and three for the exhaust. What distinguishes the Sinclair rotary valve from others of the same type is that it is not moving while there is any appreciable pressure within the cylinder. Most other rotary valves are turned at a constant speed by means of spur or similar gears, but the Sinclair valve receives its motion from a cam disk, which has an irregular slot cut in it, into which engages a roller on a lever arm secured to the valve spindle. Throughout the power stroke the valve remains stationary on its seat and it begins to move only after most of the spent gases have been swept out by the scavenging air through the auxiliary exhaust port.



Sinclair rocking valve. Upper view shows the cam groove which moves the valve intermittently, and lower view shows the form of the valve and the ports



Section through Sinclair engine with piston and valves in the intake and exhaust portions respectively

Researches on the Operating Conditions of Magnetos

France, like England, with the opening of the war, was cut off from a supply of magnetos. This article, a translation of P. M. Heldt, relates some of the researches and some of the results obtained in the French attempts to obtain their own supplies.

DURING the early part of the war, France, having been cut off from its previous source of supply of magnetos, had to make all possible haste in the development of a magneto industry of its own. In order to guide the manufacturers who engaged in the new line of manufacture, researches were conducted regarding the operating conditions of magnetos, and the peculiarities which they present. An article based on the results of these researches, by A. Contet, was recently published in *La Technique Automobile et Aerienne*, of which the following is a translation:

The magnetos which were studied were of the direct spark type. It may be pointed out that they comprise an armature of the "H" type carrying two coils, and placed in a field produced by permanent magnets. The variation of flux through the armature is produced either by its own rotation or by that of sectors of soft iron in the space between it and the pole pieces, according to whether it is desired to produce two or four sparks per revolution. The interruption of the primary circuit, at the moment when the current in it is at its maximum, induces in the secondary winding an electromotive force of sufficient intensity to cause a spark to jump the gap between the points of the spark plug. A distributor directs the secondary current to

the particular spark plug whose turn it is to ignite the charge in its cylinder.

Some of the magnetos, called inductor magnetos, are of a slightly different type. The primary and secondary windings are placed upon an iron core connecting two pole pieces between which there rotate two iron pieces which alternately throw them in magnetic communication with one or the other pole of the magnet. On the whole, the principle is similar to that of the rotating sector magneto, only the arrangement of the parts is different.

The diameter of the primary wire varies between 0.028 and 0.048 in. (Nos. 21 and 16 B. & S. gage); the number of turns varies from 100 to 150. The diameter of the secondary wire varies between 0.002 in. and 0.0048 in. The number of turns varies between 7,000 and 12,000. The weights of copper are about 1 ounce for the primary wire, and 2 ounces for the secondary wire. The wires are insulated by a flexible enamel which, in order to be of good quality, must be of dark color. It then consists of a stearine rosin. The difficulty which for a long time was encountered in the manufacture of enameled wire, resided in the purification of the stearine rosin, which, if it is not absolutely pure, spreads poorly over the wire, forming

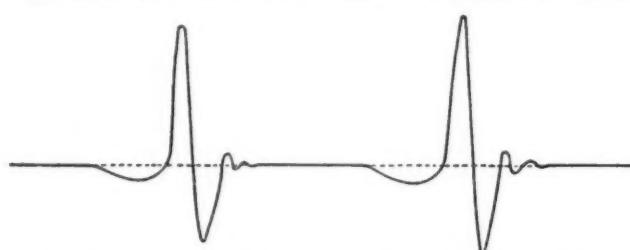


Fig. 1—Reproduction of an oscillographic plate, showing the oscillating character of the secondary current and its very short duration

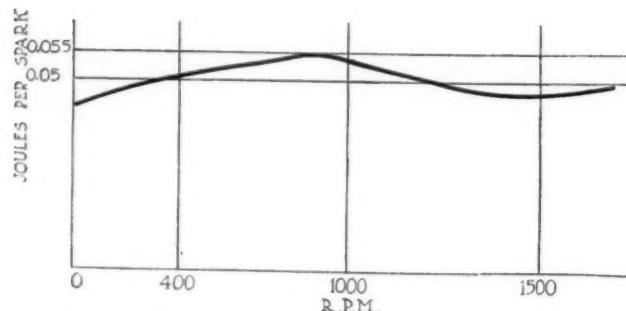


Fig. 3—Curve of energy variation of spark as a function of the magneto speed

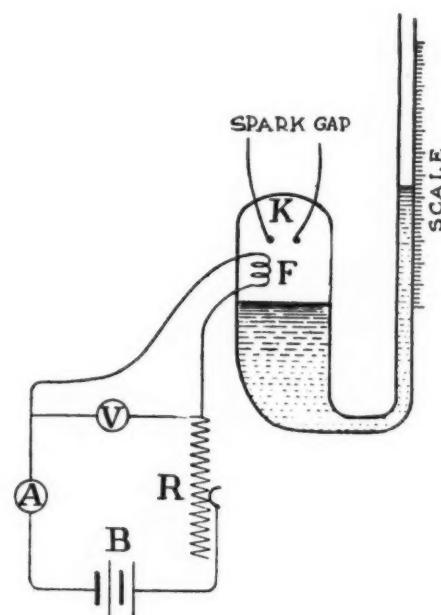


Fig. 2—Nitrogen calorimeter

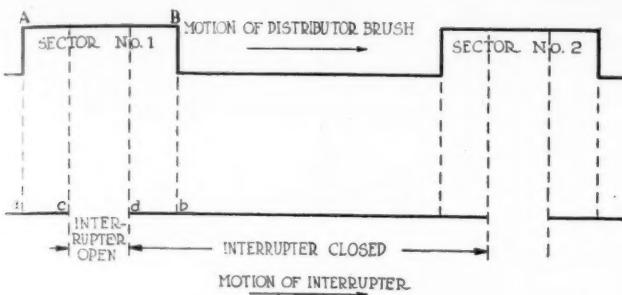


Fig. 4—Diagram of operation of interrupter and distributor. A B, short-circuited sector

beads. The dark color of the enamel is a guarantee of its quality. The rosin or pitch is used by dissolving it in benzine or gasoline, which process moreover permits of insulating other parts by enameling.

The resistance of the windings is on the order of the following figures:

Primary, 1 ohm; secondary, 2,000 to 11,000 ohms.

The primary current on short circuit varies between the following limits:

At 400 r. p. m., 1 to 2 amperes.

At 1,000 r. p. m., 2 to 2.5 amperes.

At 2,000 r. p. m., 2 to 2.75 amperes.

At 3,500 r. p. m., 2.6 to 3 amperes.

At 3,500 r. p. m., 2.6 to 3 amperes.

It will be seen that the current varies only very slightly with the speed, and one may almost consider it constant. This is due to the high value of the coefficient of self induction of the armature, and to the counter magnetic field of the latter.

PRIMARY E. M. F. ON OPEN CIRCUIT

For measuring this electromotive force it is necessary to experiment with an electrometer, for the reason that there is a material drop in voltage if the slightest current flows, on account of the very high armature reaction. The primary electromotive force, at the moment of break, attains 200 volts, which, with a transformation ratio of 50, gives a secondary electromotive force of 10,000 volts. This value, however, is of no practical interest.

On the other hand, it is extremely interesting to know not only the total variation of flux, but also the law of the variation of this flux during the rotation of the armatures. To this end, the primary winding is connected to a ballistic galvanometer, and by means of appropriate stops, the armature is caused to rotate suddenly through successive steps of an amplitude varying from 2 to 3 deg., always in the same direction. The deflections of the ballistic galvanometer indicate the variations of the flux through the armature for each of these motions.

The total variation of flux, in megamaxwells, is 4 to 7.5, according to the type. In tracing the curve of the variations of flux, one has a means of determining, except for a constant, the value of the instantaneous electromotive force for each position of the armature during its uniform rotation. One may also calculate the ratio between the instantaneous electromotive force, and its effective value. It will be found that this ratio is of the order of 3, which shows that the electromotive force is not sinusoidal, in which case the ratio would be $\sqrt{2}$.

At normal speed, in order to obtain a certain current at the moment of break, the necessary speed will be the lower the higher the constant Z, which is defined as follows:

$$Z = \frac{\text{dB}}{\text{dx}}$$

in which B is the number of lines of force and x the displacement of the armature. This constant varies with different types between 5 and 6.5.

The only interesting value of the primary current, which enters into the operation of the magneto, is the instantaneous current at the moment the circuit is broken. This is naturally the maximum value, but we have here to do with the maximum

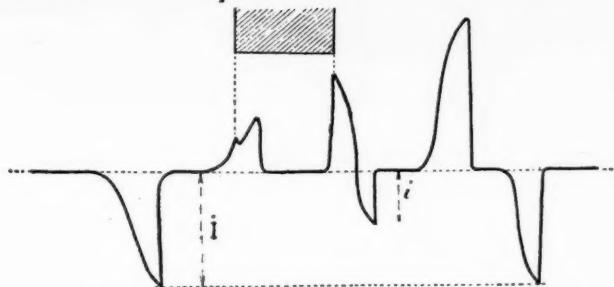


Fig. 5—Reproduction of an oscillographic plate showing the suppression of one primary current impulse by the short-circuiting of the secondary

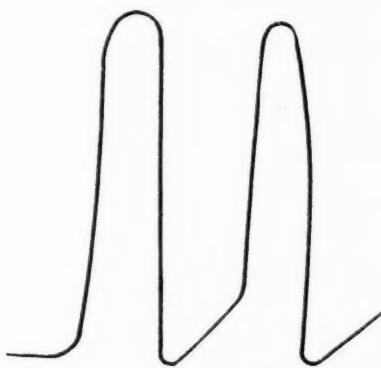


Fig. 6—Deformation of the secondary discharge

value of the first oscillation, that is to say, during the period the circuit is closed. It will readily be understood that this value may be quite different from that of the maximum instantaneous value of the current when the primary circuit remains permanently closed, and such is actually the case. The table below indicates the maximum current during the first oscillation, compared to that in a permanently closed circuit.

R. P. M.	Max. current under permanent short circuit	Max. current	
		1. Alternation	2. Alternation
500	3.5	4.5	4.2
1,000	3.5	5.4	4.6
1,500	3.3	5.2	4.6
1,750	3.3	5.2	4.6

In experimental investigations it is important to operate the primary under normal conditions, that is to say, to connect the oscillograph in series with the interrupter. In the case of magnetos with movable armature (rotating or oscillating) it is necessary to have recourse to special arrangements.

In every apparatus operating as an induction coil (a coil properly so called or a magneto) the effective difference of potential at the spark terminals in operation does not correspond to any physical constant of the apparatus.

The voltage utilized, which is of the order of several thousand volts, in general is applied only during an extremely short time with relation to the period of the apparatus. Owing to the presence of iron, even when there is no spark, the oscillations which are produced in the secondary winding are very quickly damped out, and the time during which the secondary does not carry any electric current, is a considerable fraction of the total. (Fig. 1.)

It will thus be understood that under these conditions the effective electromotive force, as measured by an electrometer connected in shunt across the interrupter, does not give any information regarding the instantaneous electromotive force, nor even regarding the effective electromotive force.

It is the same in a magneto where, independently of the phenomena of break, the secondary, owing to its rotation in the magnetic field of the permanent magnets, is the seat of

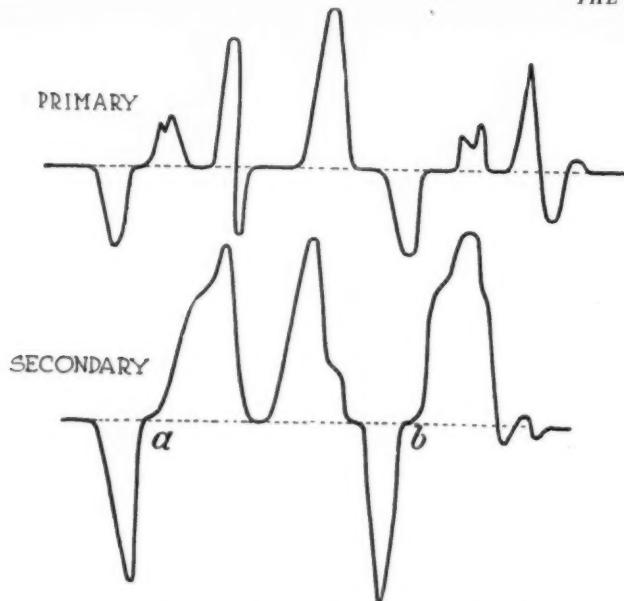


Fig. 7—Oscillographic plates of the normal operation of a magneto with sectors *a* and *b* of the secondary short-circuited

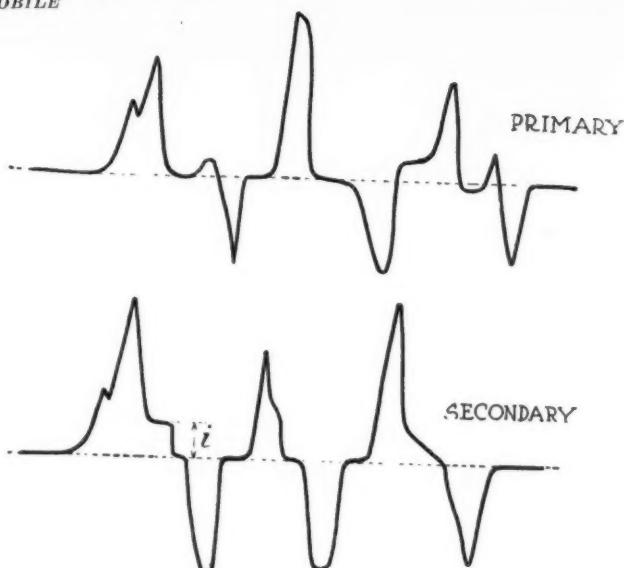


Fig. 8—Operation of magneto under the same conditions as in Fig. 7 but with resistance of 13,000 ohms in series with the secondary

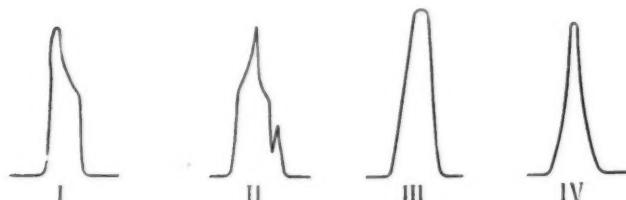


Fig. 9—Oscillographic curves of different sparks.
I, spark with sudden break; II, spark with sudden break and small parasitic spark; III, normal spark; IV, spark with resistance in series with secondary winding

alternating voltage impulses. The order of magnitude of these electromotive forces is from 200 to 300 volts when the primary is closed, and 1,000 volts when it is open. Now, under these conditions, the effective electromotive force in relation to the period of the magneto is from 200 to 300 volts, when the sparks attain a length of $\frac{1}{4}$ to 5-16 in., which indicates an instantaneous voltage of the order of 10,000.

The only rational calibration which can be made consists in connecting an electrometer in shunt across the spark gap. The spark gap is then subjected to an approximately sinusoidal electromotive force, which, for convenience, is generally an alternating electromotive force of 42 cycles, and for each length of spark the corresponding mean electromotive force is noted, which permits of calculating the maximum electromotive force. This serves as a means of comparison indicating the order of magnitude of the differences of potential produced by the coil or the magneto.

The numbers obtained should only be considered in this light and not as exact measures of the voltage produced by the apparatus. The electrical viscosity of the air, and particularly the phenomena of capacity, which impart to the discharge an oscillatory character, are the reasons why the two phenomena cannot be identified.

It is in this way that the accompanying calibration curves of induction coils were obtained; they characterize only their spark gaps. To say that a magneto, at the moment of discharge, gives a difference of potential of 10,000 volts, for example, signifies merely that in order to produce a spark of the same length in the same spark gap, requires the application to the spark points of the latter of a sinusoidal alternating electromotive force of 10,000 volts. This, however, gives no precise information regarding the real value of the instantaneous tension furnished by the magneto.

This energy is measured by determining the heat produced

by the sparks by means of a nitrogen calorimeter. This apparatus (Fig. 2), is composed of a U-shaped glass tube, the two branches of which are of unequal diameter. The large branch is closed, and contains an inert gas—generally nitrogen—while the narrow branch is open and the two branches contain a liquid which the nitrogen in expanding causes to rise in the narrow branch past the scale.

The branch which contains the nitrogen also encloses a set of spark terminals K, and a fine wire coil F. The latter, which serves for the calibration of the apparatus, is connected to a storage battery B, a rheostat R being included in the circuit. A volt-meter V and an ammeter A, indicate the electromotive force E, and the current I which flows through the fine wire.

In order to measure the energy content of the sparks, a definite number is caused to pass between the points of a spark gap. The nitrogen is heated and expands, and the liquid rises in the narrow branch of the apparatus up to a certain height, which can be fixed on the scale. For calibrating the apparatus, current from the battery is then passed through the fine wire, until the apparatus indicates the same reading on the scale. The energy delivered is then EI, and the energy of each spark is obtained by dividing this figure by the number of sparks.

It is thus found that the energy of the spark varies between 0.03, and 0.05 joule, according to the type. It is almost independent of the speed of the magneto. It is, moreover, also almost independent of the length of the spark, and in the final analysis depends only on the magnetic energy thrown into play. This shows the mistake made some 12 years ago by the magneto manufacturers when they attempted to obtain the longest possible spark.

It results from all this that the heat and the volume of the spark vary separately and inversely. As these two properties are of importance from the point of view of ignition, it follows directly that there is an optimum dimension of the spark for ignition.

It has been stated that the energy of the spark is almost independent of the speed. Nevertheless, slight variations as a function of this speed sometimes occur. The nature of these variations is represented by the curve of Fig. 3. The maximum (when there is one) is hardly distinguishable, and is produced at a speed which depends upon the type of the magneto.

The efficiency of a magneto is very low; it is of the order of 10 per cent. This is due, aside from the well known phenomena such as hysteresis, the Joule effect, etc., to the fact that the current produced is of an oscillating nature, and that this results in the dissipation of a large amount of energy in the iron.

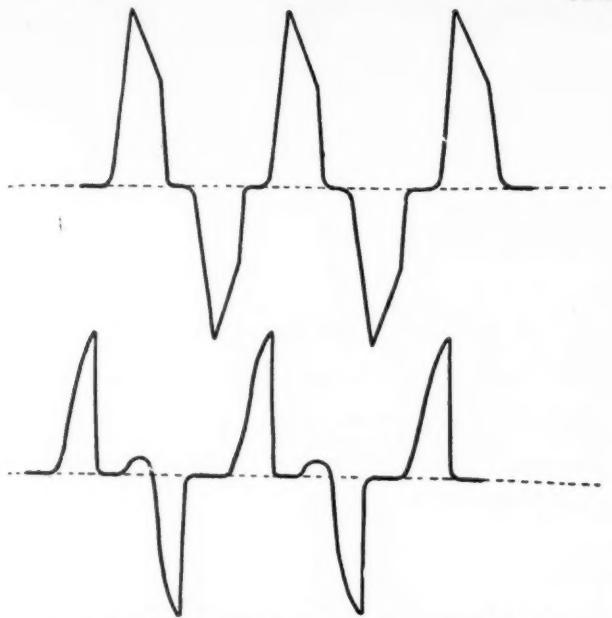


Fig. 10—Oscillographic diagram of normal magneto operation at high speed. Note the dissymmetry of the secondary and the small hooks formed on the closing of the primary

At normal speed, if the spark gap corresponding to one sector of the distributor is short-circuited, the spark corresponding to the following sector will be suppressed. This phenomenon is due to the reaction of the secondary on the primary, and may be explained as follows:

At the moment when the distributor brush passes on to the short-circuited sector, the secondary operates as a generator, and delivers approximately 0.1 ampere. Now, the brush is still on the sector of the distributor at the moment when there is generated in the primary the current which produces the spark corresponding to the next following sector.

At the moment when the brush leaves the sector, at b in Fig. 4, the secondary circuit is suddenly broken. The resulting change in current induces in the primary a current in the opposite direction to that which is normally generated therein, in conformity with the Lenz law. The production of the current is modified thereby, and it may happen that at the moment of break the current has not attained a sufficient value to produce a spark.

This phenomenon is evidenced by the oscillographic curve Fig. 5, which represents the primary current. The cross-sectioned area corresponds to the short circuited sector. It will be seen that the second alternation of the primary current is damped out by the short circuited secondary current. The disturbance created in the rise of the current during the third alternation, reduces the value of the current at the moment of break, which is normally equal to I_0 , but in this case it is only i .

Owing to the fact that the coefficient of the self induction of the secondary is very considerable (13 henrys), or, rather, that the reaction is great in relation to the resistance (1500 to 2000 ohms), the secondary current curve is very much deformed with relation to the voltage curve. The variation of the secondary current at the moment of break is of the order of the maximum value of the current during short circuit. The disturbance is generally sufficient to cause the next following spark to be suppressed.

It should be stated that the portion db (Fig. 4) of the primary current is suppressed by the short circuit in the secondary; it starts, on the whole, from zero at the moment of break of the secondary current.

In the same way the strength of the primary current corresponding to the short circuited spark is very much reduced and the disturbance caused to the curve of the short-circuited secondary current by the interruption of the primary is of little importance. This phenomenon is in general very little known among automobilists, for, in order to observe it, it is necessary that the magneto turn at sufficient speed. The

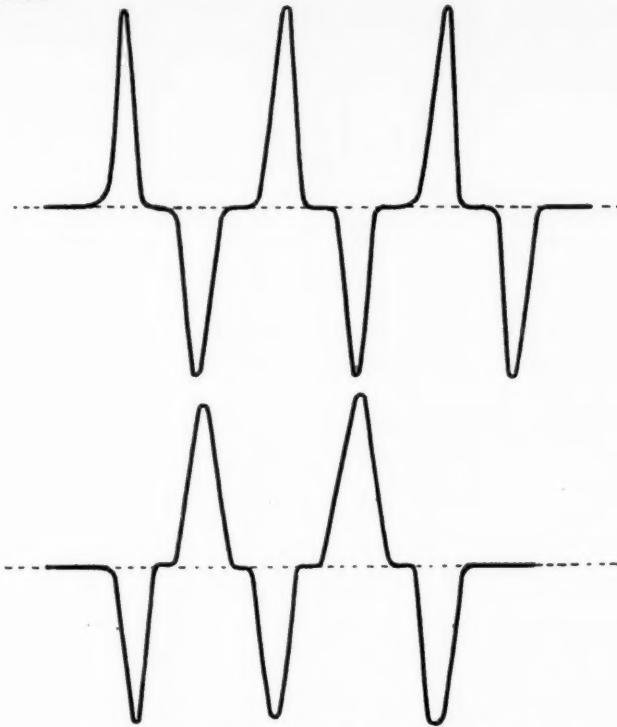


Fig. 11—The same, corrected by the insertion of a resistance of 13,000 ohms in series with the secondary

practice of determining a missing cylinder, which consists in short-circuiting successively all of the spark plugs of the engine, cannot produce the phenomenon, for the reason that the engine turns at too low a speed. Under these conditions, the primary impulse which gives rise to the spark which must follow that of the short circuited sector, is produced too late to be influenced by the break of the secondary. Nevertheless, it has been observed in some instances. Where it has been observed very often, is on 8 and 12 cylinder aircraft engines, in which the missing of one or two cylinders, although it causes an appreciable reduction of speed, still allows the engine to turn sufficiently fast, and the phenomenon then appears very distinctly.

The remedy to apply is, moreover, indicated in a patent taken out by the Bosch firm. It consists in increasing the resistance of the secondary, either by winding it with a very fine wire, or by terminating it by a certain number of turns of very fine wire of a material of high specific resistance.

The disturbance created by the interruption of the secondary short-circuit is the less pronounced the lower the value of this current itself at the moment of break. If the resistance of the secondary is increased with relation to its reactance, the form of the current curve approaches more and more to that of the voltage curve; it presents a very distinct maximum and a very rapid drop. In that case, therefore, the current at break will be much less. In fact, it suffices to add to the secondary a resistance of some thousand ohms. This is shown very clearly by the oscillographic plates Figs. 7 and 8. The upper curve in each of these figures shows the variation of the primary, and the lower that of the secondary (the scales bear no relation to each other). Fig. 7 refers to a magneto with an ordinary secondary winding, while Fig. 8 refers to a magneto the secondary winding of which has a resistance of 1,300 ohms in series. These curves show distinctly the difference between the currents at break, i and i_0 , of the secondary.

This addition of resistance diminishes the liberation of heat in the spark. There is a best value of resistance to be added, which varies with the type of magneto, and for which the sparks suppressed reappear with the liberation of heat sufficient to assure ignition and without the heat of normal sparks being excessively diminished. As a first experimental approximation, the optimum additional resistance may be placed at 10,000 ohms.

(Continued on page 1231)

Bulgaria Needs American Automobiles

The war taught Bulgarians the usefulness of the automobile. Bulgaria now offers an excellent market for American cars, but certain difficulties must first be overcome. Mr. Gheorghiew knows the automobile needs and difficulties of Bulgaria thoroughly and presents them clearly in this article, which is not only interesting but authoritative.

By A. M. Gheorghiew*

BEFORE the last war only few automobiles were imported into the Balkan States, and as a means of communication they were not particularly popular. Among the reasons for the slow development of the automobile movement in these countries may be mentioned the insufficiently developed road systems, the high prices of motor cars, the lack of experienced drivers and of well equipped repairshops, and finally the slight interest shown by foreign automobile manufacturers in the Balkan markets.

The war, with its pressing demand for rapid and reliable means of communication, compelled all the belligerents to utilize passenger automobiles and motor trucks to the utmost. These vehicles proved to be an excellent complement to the railroads. In the Balkan States, where the railroad services are entirely inadequate, the automobile had to perform a specially difficult task, in that it not only had to serve as an auxiliary to the railroad, but in certain districts, where no railroads exist, it had to take over the entire transport work. Of course, the enormous number of different kinds of cars needed by the armies induced the automobile manufacturers to increase their outputs. Orders for ten of thousands of motor cars were placed by the great European nations in the United States, as the home industries of these nations were not able to meet the needs of their Armies. The automobile plants in the different countries adapted themselves to the new conditions quickly. Their production was increased remarkably and new factories were established to meet the suddenly increased demand.

At last the war came to an end, and the industries then faced new problems. To make the transition from war conditions to a peace footing with the least possible disturbance, it is necessary that the new conditions confronting industry and commerce be kept in mind. It is the object of the writer in the present article to outline, from the standpoint of automobileing in the Balkan countries, the conditions under which motor cars have so far been sold and used in the Balkans, and then take up the steps necessary for the foreign manufacturer in order to sell this market. Provided the market is properly cultivated, and allowance is made for local commercial and technical peculiarities, it should be possible to sell a considerable number of different kinds of motor cars in the Balkan States.

CONDITIONS OF THE PAST

Scores of automobile manufacturers, several of them American, made half-hearted attempts to find on the Balkan Peninsula a market for the machines, but not one has made a persistent effort, or has gone into the business on a large scale. The result is that each firm is represented by a small number

of cars, and none of them—making an exception of army orders—has any considerable number of cars in service. Thus, the cars in use in the Balkans are of many makes and models, which, of course, renders efficient service a difficult matter.

Very little has been done to demonstrate to the people the usefulness and the advantages of the automobile, to prove that it is a reliable, quick and economical means of communication when properly used. Only the severe and extensive use of motor cars during the war gave the people a certain opportunity to appreciate their qualities.

During the war, a great many men were trained as automobile drivers, so that now there is no dearth of drivers possessing the necessary skill and technical knowledge. There are, however, only few repairshops which are well equipped with machine tools, hand tools and a staff of competent workmen. Thus, it is often difficult to get the more serious breakages and derangements repaired.

SALES AGENCIES

The automobile trade is partly in the hands of specialists who deal in nothing but automobiles, and partly in the hands of general merchants. The better-equipped firms, of which there are only a few, have in addition to their offices a salesroom permitting the display of several cars, a stockroom with a scanty supply of spare parts, and a small repairshop. The organization of motoring as a sport is quite new, and still remains to be developed.

There are as yet few companies making use of the automobile in a commercial way. In a few localities there are automobile passenger services which connect the more important towns and the nearest railroad stations. Motor taxicabs are entirely unknown. Motor trucks are very rarely used in industry and agriculture. Motor plows and other motor propelled machines on the farm are rare.

Aside from military institutions, there are only few government establishments which make use of motor cars to any extent. Even the number of cars in service by the Post-Offices is quite limited.

The conditions of maintaining cars in a state of efficient service are at present very difficult, as there is a lack of spare parts, which is largely due to the great variety of cars in service; repairwork is expensive, supplies of tires, gasoline and lubricating oils are difficult to obtain, and the prices of these commodities are exceedingly high.

To insure prompt and satisfactory results in developing an automobile business in the Balkan States, close co-operation between the local undertaking and the foreign factories is necessary. The sales organization preferably should be backed by both local and foreign capital, and the staff should comprise both local men and foreigners. The latter should include experienced merchants and engineers, while the local men should be enterprising and possess special knowledge of the automobile trade and of local conditions generally.

*Mr. Gheorghiew of Sophia, Bulgaria, is the manager of the largest motor car work shop in Bulgaria and is assistant to the chief of the entire government automobile service in that country.

It is necessary first to explain to the population the advantages of the different kinds of automobiles as a practical and convenient means of transportation. To this end, use should be made of simple cost and profit calculations, circulated on a large scale. Technical books written in popular language, pamphlets and prospectuses containing brief descriptions of the chief features of automobile construction and also dealing with the use of automobiles, and, finally, well written advertisements, can all be used to advantage. In all this literature a popular style of treatment should be maintained. Publication of a periodical dealing with automobiles, motor boats, motor plows and other similar machines, would also be helpful.

Another thing that will help in stimulating interest in automobiles is the promotion of machinery exhibitions with considerable space devoted to motor vehicles. Demonstration runs with different cars into the most remote parts of the country, would help to make the population familiar with the motor vehicle. Such runs would afford an opportunity of explaining to the people the peculiarities of the cars, the best methods of keeping them in repair, and of using them to the greatest advantage.

Companies could be organized—partly with local and partly with foreign capital—to operate motor vehicle services between inland towns and seashore resorts, most of which are at a considerable distance from railroad lines.

Perhaps nothing would be more effective in helping to develop an interest in motoring in these countries than the establishment of factory branches by leading automobile firms. Such branches should have a skilled personnel of both technical and commercial men, the latter thoroughly familiar with local trade and conditions. They should have a well appointed showroom and a stock room with an adequate supply of spare parts for the different models, these carefully stored in such a manner as to be readily accessible. These establishments should also deal in accessories and in supplies needed by motorists. Attached to the sales department should be a well equipped repair shop. Special emphasis should be laid upon the point that success in developing an automobile business depends to a very large degree upon the care which is given to the prompt supply of spare parts and accessories, and upon the service given by the repairshops. Efficient service is the only means of gaining the confidence of the public.

As the prospect for the sale of cars increased, the firms having established these branches might consider the advantages of enlarging them so as to make it possible to manufacture some of the parts locally. If such a step be decided upon, it would undoubtedly be necessary to enlist more capital from the country of the parent firm.

Officials of the branch houses should remain in constant contact with their customers, gathering detailed information regarding the results obtained with their cars, as well as information regarding mishaps suffered with them, and any possible fault in construction. Service must be rendered particularly to those customers who live in remote districts where there are no well equipped repairshops. Only in this way can customers be expected to get the greatest possible use out of their cars.

TYPE OF VEHICLE NEEDED

It will help the general movement to establish tire stores and fuel and oil supply stations, as these supplies are at present very difficult to obtain in the Balkans, and the prices asked for them are very high. The sooner the fuel supply problem is solved, the sooner there will be a market for a considerable number of motor vehicles.

As regards the engineering features of a type of automobile specially suited to the Balkan Peninsula, much light was thrown upon this matter by the experiences had during the late war.

Motor vehicles for the Balkans must be designed with a view to serviceable use on the poorly maintained roads with heavy grades. High speed is non-essential, as in view of the poor condition of the roads, there is no opportunity for utilizing it. A speed of 12 to 16 m. p. h. for motor trucks, and 35 to 55 m. p. h. for touring cars is all that is needed. In view of the poor state of the roads, light trucks of from 2½ to 3 tons useful load capacity are best. Road tractors are not serviceable.

As regards touring cars, light vehicles of simple construction are most popular, both on account of their relatively low cost, and their moderate upkeep expense. Simplicity of mechanism is desirable because the great majority of the vehicles will be driven by their owners who are not experts in motor machinery.

MECHANICAL NECESSITIES

All vehicles should have a minimum road clearance of 8 in. in order to avoid scraping the road when running in deep ruts. Owing to the mountainous nature of the country, the brakes and steering gears must be of very strong design, as steep grades and sharp curves abound. The cooling system must be of very liberal proportion, as long ascents are frequent, and the summer is hot. The carburetor should be adapted to consume both gasoline and benzol, and a number of nozzles are furnished if possible.

Engine lubrication should be automatic, reliable and easily looked after, even by an inexperienced driver. Moreover, the designer must bear in mind that the lubricating oils procurable in the Balkans are of a very indifferent quality. An electric starter and electric lighting equipment are very desirable adjuncts. Storage batteries on a car without a generator are practically useless, as in most parts of the country there are no electrical stations where the battery could be recharged.

Owing to the rough road surfaces, it is advantageous to use tires of a somewhat greater width than are normally fitted.

As already mentioned, hitherto, automobiles have been sold in the Balkans in very limited numbers, but the need for them is rapidly growing. With their enormous production, American manufacturers will soon be in need of outside markets, and as their cars are of good quality and relatively cheap, these vehicles could be sold here without any difficulty by a properly equipped organization. There has never been such a favorable time for the introduction of American automobiles as the present, and American manufacturers would be ill-advised if they missed this opportunity, as within the near future there will be serious competition from other industrial countries.

If American manufacturers will assume the initiative, establishing relations with experienced, reliable and enterprising local merchants, and invest a moderate amount of capital, they can soon work up a very promising market in the Balkan Peninsula.

British Production Per Man

INQUIRIES among British manufacturers reveal a considerable falling off in the output per man in motor car plants. Striking the average of a number of cases where production models have been issuing shows that while the staff, which includes work-people and office employees, has increased by 50 per cent since 1914, the output of cars is 30 per cent down. This is unquestionably due to two factors, one being the smaller number of working hours per week, and the other the lack of energy displayed by the staff. Labor (trades union) officials argued that each man's output capacity per day would be increased rather than reduced by the smaller number of hours' work per week, especially as he would be encouraged to expend his best endeavors by the higher scale of wages; but results have proved otherwise. Instead of the output per man increasing, it has been reduced, as shown above.

Possibly, however, this falling off to a certain extent will be rectified when the men really give of their best. Practically during the whole of this year the men in a great number of factories have been adopting the "go easy" attitude, and have got through as little work as they could. This attitude, it must be admitted, has not been adopted with the approval of the Trades Union officials, but arises from an unofficial movement among the men themselves. There are, however, signs of an awakening as to the stupidity of this policy, and, with some reason, the hope is expressed that 1920 will show an output per man per hour at least equal to that of 1914.

Scientific Flight Study Urged by National Aeronautic Body

National Advisory Committee for Aeronautics points out problems and describes constructive work being done in this field. Air mail service an important contribution

By Allen Sinsheimer

THAT the Government must give liberal support to the development of military, naval and postal aeronautics, and to the National Advisory Committee for Aeronautics for a continuous scientific study of flight, and encouragement through proper Government channels for foreign trade in aircraft and for the establishment of landing fields, is emphasized in the fifth annual report of the National Advisory Committee for Aeronautics. The report states that legislation must be enacted at once for the regulation of civil aerial navigation, licensing of pilots, inspection of aircraft and enforcement of regulations, and recommends that these duties should be temporarily placed under the Department of Commerce. It suggests that a special aeronautical mission should be sent to South America to create markets for American aircraft, and the War Department should be authorized to co-operate with the various municipalities to aid in laying out and marking landing fields and constructing hangars.

"A continuous program for the construction of aircraft for the various governmental services should be authorized to assure, through the procurement of relatively small orders among manufacturers of aircraft" is recommended by the report, "the existence of a nucleus of the aircraft industry capable of extension to meet military needs in an emergency.

That the air mail service is a most important contribution to the practical development of commercial aviation is one of the significant statements in the report. "Early advices received by the Post Office Department," says the report, "were that there would be great difficulty in maintaining a daily schedule of mail flights, and the opinion was that the service would be interrupted during the winter months and perhaps at other times when conditions might be considered unpropitious. During the last fiscal year, only 4.4 per cent of the scheduled trips were not attempted and there were only thirty-seven forced landing due to mechanical troubles. Out of a total of 138,310 miles possible, there were flown 128,255 miles, or a performance of 92.73 per cent.

FUNCTIONS OF THE COMMITTEE

The report which dwells in detail on the functions of the Committee and its sub-committees and which have previously been described in these columns, states that the Committee has a field station comprising a research laboratory, aerodynamic laboratory, and engine dynamometer at Langley Field, Va., which it is planned will be moved to Bolling Field, Washington, where the work can be carried on more economically and satisfactorily. During the past year the Office of Aeronautical Intelligence Division of the Committee has collected and distributed 7,441 copies of technical reports to the business papers, various industrial organizations, technical societies, etc. It established an office in Paris in June of 1919 which collects and exchanges reports and data.

It was importantly engaged in the revision of the International Air Navigation regulations of the Peace Treaty, working co-operatively with the Department of State. It believes that the greatest need at the present time for the development of civil aerial transport is the proper location and maintenance of landing fields in every city and town, to be established and maintained by the municipalities as a part of the park system, but to be laid out in co-operation with the Government officials. "Commercial aeronautics will be very slow, indeed, to get started in the United States," says the report, "in the absence of material help and encouragement from the Government."

STANDARDS COMMISSION

Because Congress did not vote for the necessary appropriation, the United States was without representation in the June 1919 meeting of the International Aircraft Standards Commission, and the Committee is again recommending to Congress that it give its approval to the participation of the United States in these meetings. In the absence of such approval, the Committee is undertaking to establish aeronautical standards in this country in co-operation with the Bureau of Standards and Military and Naval Air services. It is continuing its work on the standardization of English nomenclature for aeronautics and it proposes to make the nomenclature comprehensive to illustrate distinctions and to include areodynamo symbols. It is also continuing active investigations in aerial photography, aerial survey, aeronautical investigations, medical research work on aviators and theoretical aerodynamic investigations. Autographic recording instruments for free flight tests have been developed for the Committee by the Bureau of Standards, including an air speed meter, angle of attack meter, recording tachometer, torque meter and a thrust meter. Investigation of the open scale altimeter diaphragms, elastic fatigue and altitude correction for aerial speed indicators, has been undertaken by the Bureau of Standards for the Committee.

The report continues, "the work on the open scale altimeter has progressed to a point where a working model of the essential parts of the altimeter, exclusive of the indicating mechanism, has been assembled and tested. By proper theoretical design of the spring and diaphragm elements, an instrument has been made whose performance depends on the material of the steel spring almost entirely and only to a slight degree on the material of the diaphragm. It has been possible to secure steel nearly free from elastic fatigue effects although such is not the case with the alloys used for the thin, flexible diaphragm. As a result this instrument has been shown by test to have less than one-third of the fatigue effects (for example, discrepancy between increasing and decreasing readings) permitted by the Bureau of Standards specifications for altimeters. The object of this work, which will be continued until completed, is to provide a precision altimeter suitable for altitude determination in aircraft performance tests.

"Thin metallic diaphragms, usually corrugated for flexibility, form a necessary element in a great variety of engineering instruments, particularly in aneroid barometers for altitude measurement, in air speed indicators, certain forms of stethoscopes and rate-of-climb indicators, balloon manometers, and aviator's oxygen control apparatus. Such diaphragms are never perfectly elastic but show what are known as fatigue effects, failing to recover instantly from the deformation undergone in the normal operation of the instrument; hence, the importance of experiments to select the most promising alloys, to determine the most effective thermal and mechanical treatment in the process of manufacture, and to establish the most efficient geometrical design for the diaphragms when used either singly or in combinations. Up to the present this investigation has resulted in the development of measuring appliances for detecting the small changes in question by micrometric methods, in the preparation and use of suitable shop equipment for spinning sample diaphragms at the Bureau in considerable numbers, in a preliminary study of a variety of alloys to select those which warrant more detailed study, and in a special study of mechanical seasoning processes. This last phase of the work has led to the conclusion that diaphragms can be seasoned mechanically; that is, artificially aged and thus brought into a permanent state where they will repeat their performance in successive tests under the same conditions. This is done by repeated deformation of suitable amount several thousand times and is done automatically by a mechanism designed for the purpose. Some such seasoning process appears to be a necessary preliminary to the comparative measurement of the effects of different processes of heat treatment, different compositions of the alloy and different mechanical design. The seasoning process, it will be understood, is not intended to eliminate elastic fatigue, although it does always reduce it somewhat. The object of the seasoning is to secure definite and uniform results so that those factors which will diminish the fatigue can be analyzed quantitatively.

"It has hitherto been taken for granted that Venturi tubes when used for air speed indicators will follow a familiar law which states that the suction produced is directly proportional to the density of the air and to the square of the speed.

"The object of this investigation is to determine by direct experiment whether this law does apply to Venturi tubes or whether on the contrary the compressibility and viscosity of the atmosphere may cause some effects which will complicate the correction of these instruments for different altitudes. The experiments are conducted in a so-called vacuum wind tunnel (that is, a very small air-tight wind tunnel in which reduced pressures corresponding to high altitudes may be secured). The conclusion has been reached that the instruments examined are free from the effect of compressibility but not entirely free from the effect of viscosity. These experiments are to be completed and brought to a conclusion which can be expressed numerically for the purpose of correcting such instruments when used in aircraft performance tests.

"The general report on aeronautic instruments presents the results of investigations made during the war by the Bureau of Standards to determine the characteristic sources of error of the various types of instruments. Tachometers, for example, for measuring the revolutions per minute of the propeller shaft, are built in a variety of different types, operating on diverse physical principles. These are the chronometric, centrifugal, magnetic, electric, air viscosity, air pump and liquid types, each of which has its own characteristic sources of error. Aside from the ordinary errors met in engineering instruments, such as incorrect calibration, parallax, looseness of friction in the mechanism, elastic hysteresis, and secular changes, those used on aircraft may be further influenced by the physical conditions peculiar to aviation, namely, (1) extreme drop of pressure (2) extreme change of temperature (3) vibration (4) acceleration or inclination. Besides the above results, this report, which is nearly completed, gives a description of the instruments collected by the Bureau of Standards in co-operation with this Committee during the war including those of British, French, Italian, Russian, Danish and German construction.

"In the light of that report it will be evident that the objects toward which instrument development work should chiefly

be directed in the immediate future may be summarized as follows:

"1. Open scale instruments for performance testing of aircraft. These need not necessarily be so compact, light or rugged as service instruments and hence offer freedom for such design as will insure the highest accuracy.

"2. Instruments for long distance navigation, including an absolute ground speed indicator, and such a form of gyroscopic stabilizer as may be needed for mounting the instruments.

"3. Instruments to guide the pilot in flying through fog, such as more reliable gyro turn indicators and compasses.

"4. Better materials for springs and diaphragms and more systematic determination of the thermal and elastic constants of the materials.

RADIO LANDING DEVICE

"The Bureau of Standards has developed (primarily for the Air Mail Service) a field-marking radio device which enables a pilot to steer directly to the center of his landing field although it may be obscured by clouds, rain, snow or fog. This apparatus utilizes the same transmitting equipment for the ordinary radio direction finding signals and for the landing signals. The landing signals are projected vertically as an electro-magnetic cone of great intensity, which can be heard satisfactorily at an altitude of three or four thousand feet. The device enables the pilot to first find the approximate vicinity of a landing field and then fly directly to its center, thus making a safe landing in a fog or in the dark. As elevated aerial systems are manifestly dangerous to air navigation, the Air Mail Service experimented extensively in radio transmission with antennae only 20 ft. in height, highly directional, and admitting of sharp tuning. The installation of high powered in the vicinity of flying fields is therefore made possible.

Technical reports issued during the last year by the Committee, include numbers fifty-one to eighty-two as follows:

- Report No. 51. "Spark Plug Defects and Tests."
- Report No. 52. "Temperatures in Spark Plugs Having Steel and Brass Shells."
- Report No. 53. "Properties and Preparation of Ceramic Insulators for Spark Plugs."
- Report No. 54. "Effect of Temperature and Pressure on the Sparking Voltage."
- Report No. 55. "Investigation of the Muffler Problem for Airplane Engines."
- Report No. 56. "Heat Energy of Various Ignition Sparks."
- Report No. 57. "The Subsidiary Gap as a Means for Improving Ignition."
- Report No. 58. "Characteristics of High-Tension Magneto's."
- Report No. 59. "General Analysis of Airplane Radiator Problems."
- Report No. 60. "General Discussion of Test Methods for Radiators."
- Report No. 61. "Head Resistance Due to Radiators."
- Report No. 62. "Effect of Altitude on Radiator Performance."
- Report No. 63. "Results of Tests on Radiators for Aircraft Engines."
- Report No. 64. "Experimental Research on Air Propellers, III."
- Report No. 65. "Kiln Drying of Woods for Airplanes."
- Report No. 66. "Glues Used in Airplane Parts."
- Report No. 67. "Supplies and Production of Aircraft Woods."
- Report No. 68. "The Effect of Kiln Drying on the Strength of Wood."
- Report No. 69. "A Study of Airplane Ranges and Useful Loads."
- Report No. 70. "Preliminary Report on Free Flight Tests."
- Report No. 71. "Slip-Stream Corrections in Performance Computation."
- Report No. 72. "Wind Tunnel Balances."
- Report No. 73. "The Design of Wind Tunnels and Wind Tunnel Propellers."
- Report No. 74. "Construction of Models for Test in Wind Tunnels."
- Report No. 75. "The Aerodynamic Properties of Thick Aerofolts Suitable for Internal Bracing."
- Report No. 76. "Analysis of Fuselage Stresses."
- Report No. 77. "The Parker Variable Camber Wing."
- Report No. 78. "The Limiting Velocity in Falling From a Great Height."
- Report No. 79. "Bomb Trajectories."
- Report No. 80. "Stability of the Parachute and Helicopter."
- Report No. 81. "Comparison of U. S. and British Standard Pitot-Static Tubes."
- Report No. 82. "Airplane Stress Analysis."

Daring Driving Wins Targa Florio for Andre Boillot

Young Frenchman, driving small Peugeot, braves death for eight hours to win first European post-war race. Rene Thomas, closest contender, forced to retire in fourth lap of most grueling race ever held. The story of the race is graphically told by W. F. Bradley, who needs no introduction to our readers

By W. F. Bradley

Palermo, Sicily.

COLLIDING with the grand stands and cutting the line on reverse gear, André Boillot won the Targa Florio, the first European post-war race, on the 153 cu. in. Peugeot with which he figured at Indianapolis. His average speed was 34.2 m. p. h.

It was the most grueling race ever held in Europe, and Boillot only succeeded in winning it by playing with death every yard of the way. Luck favored him, and he wore down the older and more experienced drivers who would not take the chance the young Frenchman incurred.

The race was for a distance of 268½ miles, being four laps of a mountainous course having 1500 distinct turns, and a surface which had been deteriorated by four years' neglect. The race started by the side of the Mediterranean, with orange and lemon groves in the vicinity. Here the roads were rough and heavy with mud, but on the highest portion of the course, 3000 ft. above sea level, reached after 35 miles steady climbing, snow lay on the road, and it was snowing when the first cars went by. At the start heavy rain fell and conditions were such that a postponement was suggested. The majority of the drivers expressed themselves in favor of starting, however, and the race went on.

The outstanding feature of the tenth Targa Florio was a duel between René Thomas and the 8-cylinder Indianapolis Ballot, and André Boillot on the small Peugeot which also raced in America this year. Thomas started in seventh place, with six powerful cars ahead of him. He passed them all, making his initial lap of 6 miles in 1:58:25, which was

faster time than had ever been done in practice. On this lap Thomas lost his fan belt and a hood strap. To replace them, put in water, change his wire gauze face mask and put on gloves, cost him 8 minutes.

When Thomas stopped at the end of his second lap to take in gas, he was informed that Boillot had beaten him on the initial round by four minutes. With the 8 minutes for pit work added to this, Thomas was 12 minutes behind on the first lap. When Boillot came round a second time, it was seen that he still had a lead of 7 minutes on the 8-cylinder Ballot. Thomas could not be informed of this until he had finished his third and was about to start on his last lap. He did not stop, but signals were given him that he must take a last desperate chance, or be beaten by the Peugeot.

Thomas was thoroughly awakened to action, for he had only 67 miles to wipe a handicap of 11 minutes. It is doubtful if he could have done it if all had gone well. But ill luck followed him. Driving hard, he skidded on one of the many turns, struck the protecting wall and broke his rear axle.

BOILLOT'S DARING TACTICS

André Boillot's tactics were to drive all out, and to accept all risks from the very beginning. He could not afford to stop at the pits, and while his gasoline supply was just sufficient to cover the entire distance he arranged for an emergency supply of six gallons to be given him at half distance. This was tossed to the mechanic as the car slowed down at the end of the second lap, and was dumped into the tank when running down hill. At the end of the third lap the road had become so dry that Boillot decided to change his steel studded rear tire for a smooth tread. This was his only complete stop.

In his daring driving Boillot had innumerable narrow escapes. Six times he missed his turns and went right off the course. On another occasion a child ran across the road and to avoid him the Peugeot jumped a boulder and went into the field.

With Thomas out, the race was practically in the hands of the Peugeot, but as Boillot did not exactly know the position of the next car, an Itala driven by Moriondo, he continued to drive hard. Approaching the finishing line, he noticed that spectators had invaded the course. Braking hard, he spun round twice on the grassy road, and shot diagonally into the grand stands, slightly wounding two civilians and two soldiers. The car was pulled clear of the wreckage and Boillot and his mechanic, who had been thrown out, were lifted back into their seats. As the rear of the car was turned towards the finishing line, Boillot slipped into reverse and cut the line backwards. Unable to walk he was lifted out of his car. A few seconds later a cry went up from the Italian partisans that the Frenchman would be disqualified for finishing on reverse. Immediately

RESULT OF 1919 TARGA FLORIO RACE

Distance 268½ Miles

	1st Lap	2d Lap	3d Lap	4th Lap	
1. Boillot, Peugeot..	1.54.36	1 3.52.54	1 5.48.58	1 7.51.01	1
2. Moriondo, Itala..	2.09.15	6 4.17.35	5 6.20.11	3 8.21.46	2
3. Gamboni, Diatto..	2.08.11	3 4.14.41	4 6.25.08	5 8.33.28	3
4. Masetti, Fiat....	2.08.24	4 4.13.17	3 6.23.56	4 8.41.19	4
5. Negro, Nazzaro..	2.10.19	7 4.20.31	6 6.33.01	6 8.42.05	5
6. Masetti, Aquila..	2.13.19	10 4.28.49	7 6.55.17	7 9.13.03	6
7. Sivocci, C. M. N. .	2.28.33	12 5.03.28	8 7.16.37	8 9.26.33	7
8. Baldoni, Nazzaro..	2.53.06	14 5.19.15	10 7.41.51	9 9.59.47	8
Thomas, Ballot..	1.58.25	2 3.59.52	2 5.59.11	2 Broke differential	
Ferrari, C. M. N. .	3.02.49	16 5.25.24	11 7.44.46	10 Running at end.	
Lopez, Flat.....	2.59.50	15 5.19.09	9 7.52.18	11 Running at end.	
Ferrario, Lancia..	2.12.45	8 5.59.09	12 Abandoned		
Franchini, Alfa..	2.12.51	9 Abandoned			
Scales, Eric-					
Campbell	2.27.08	11 Broke steering arm			
Campari, Alfa..	2.28.45	13 Leaky radiator			
Landri, Itala..	2.08.42	5 Broke differential			
Frascassi, Alfa..	Burned out bearings				
Ascarli, Fiat....	Dropped down ravine				
Reville, Peugeot.	Collided with wall				
Gallanzi.					
Gallanzi	Car took fire				
Ghia, Diatto.....	Bent front axle				

Boillot and his mechanic were lifted back into their car, for they were hardly able to walk, the Peugeot was driven thirty yards down the course, turned round, and run across the finishing line for a second time. The race won, Boillot collapsed in his seat.

The tenth Targa Florio was open to five classes of cars, according to cylinder bore, the cup going to the fastest, irrespective of class, and a detailed award being made according to the classes. Several of the drivers were amateurs, but all were experts at the wheel.

Rain was falling at the hour set for the start, 7 a. m., and the upper portion of the course was under snow. The big cars went away first, the man to open the course being Ferrario on a stripped touring type Lancia. The best drivers in this group were Moriondo and Landi on rotary valve Grand Prix type Italas, Baldoni and Negro on racing type Nazzaros, and Thomas with the 8-cylinder Indianapolis Ballot. The Frenchman started seventh, but on the first lap easily passed all the six who had gone away ahead of him.

While the initial lap was in progress a report came in that Ascaris, with the Grand Prix Fiat, had broken all records for the first 30 miles. After that no news of this car was received for two hours. It appears that driving fast Ascaris missed one of the turns and shot 70 feet down a ravine. Nobody saw the accident, and the car was so far down that many competitors went by without perceiving it. It was the

mechanic of a machine going slowly who noticed the wheels of the car uppermost at the bottom of the ravine, and who gave warning at the nearest village. The Fiat mechanic broke his collar bone, and Ascaris suffered serious injury. Both men will recover. The car carried No. 13.

A Gallanzi car, driven by its owner-and builder, took fire and was completely consumed. Ghia's Diatto missed a turn, and bent the front axle. Reville, on the sister Puegeot to the one driven by Boillot, jammed his steering gear and crashed into a wall at 40 miles an hour.

Jack Scales, the driver of an Eric-Campbell, the only English car to start, broke his left steering arm. He covered 30 miles down the mountain side with only the right hand road wheel under control.

By the end of the second lap 10 out of the 21 starters had fallen out of the race. After Thomas had been eliminated on his last lap real competition ceased to exist, for Moriondo's big Itala easily came in second and Gamboni's Diatto got third place without much difficulty.

The Peugeots', the Ballot and the Fiats all had front wheel brakes. There is no doubt that these brakes helped enormously. They were particularly effective on the Ballot, which car held the road better than any of the others, and ought to have won if Thomas had not been deceived into too cautious driving at the outset.

Test of Gage Blocks at Bureau of Standards

PRECISION gages are made so nearly perfect that it is impossible to determine their errors with any contact micrometric apparatus. Apparatus and methods which make use of the interference of light waves must, therefore, be employed in their calibration. For the purpose of detecting any changes which might be taking place in their length, the Optical Division of the Bureau of Standards has calibrated, relative to the standard light waves, during the past year, several sets of gages to be used as secondary standards. During this time, several thousand gages were compared, for different manufacturers, with these secondary standards, and, to determine their constancy, a large number of these gages were retained at the bureau and tested from time to time. Most of these remained remarkably constant. Some 2-, 3-, and 4-inch ones, however, changed in length from two to six-thousandths of an inch in a few months. Although changes of this magnitude are too small to be detected with certainty by any micrometric instrument and are, therefore, negligible when the gages are used in mechanical work, they are very important in the case of secondary standards.

Some experiments have been carried out to test the immediate effect of relatively large temperature variations on gages. For this purpose, several gages were cooled to liquid air temperature and then brought back to 20 deg. C. Some returned to their original length within a few millionths of an inch; but one 3-inch gage was found to be 0.0022 in. longer, and one 4-inch 0.0023 in. longer after treatment. Several were heated to different temperatures and allowed to cool to 20 deg. C. One 2-inch which had been heated to 110 deg. C. was found 0.0002 in. longer; and one 4-inch heated to 200 deg. C. 0.0017 in. shorter after being carried through the temperature cycle. Of three gages heated to 300 deg. C. two regained their original length exactly, while one 4-inch increased in length 0.0005 in. In those cases where large changes took place, it seems probable that strains must have existed in the material which were relieved by the large changes in temperature.

With the object of finding the most permanent material, the Metallurgical Division of the Bureau has undertaken the work of applying different heat treatments to several kinds of steel. The first length measurements on over 300 of these samples were made during the past month.

The linear thermal expansion coefficients of a large number of gages have been determined and found to vary from 11×10^{-6} to 13×10^{-6} p. deg. C. It is very necessary, therefore, in making accurate comparisons of long gages to have them, when used, very near the specified temperature of 20 deg. C.

Measurements have been made on the forces necessary to separate gages which had been brought into close contact. A large number of tests showed that 25 to 35 lb. per sq. in. were needed to separate gages whose surfaces had been given the ordinary finish. With gages whose surfaces had been given a high optical polish and tested for planeness by the optical method of interference, forces as high as 100 lb. per sq. in. were required. A large number of tests show that the separating film between gages that have been carefully brought into contact is less than 2 millionths of an inch.

PROF. MARTINY appeals in *Du Motorwagen* to German explosion engine designers to develop a crude oil engine sufficiently light in weight to make it suitable for farm tractors. His reasons are that the only fuels now available in sufficient quantity in Germany are gas oil, tar oil produced by the distillation of brown coal and tar oil obtained as a by-product in the production of benzol from coal. In many parts of Russia also the only fuel available is crude oil. The engines that are now being built to burn crude oil are entirely too heavy; considerations of traction resistance and packing of the soil, especially in deep plowing, demand a light engine.

THE National Advisory Committee for Aeronautics, Washington, has issued Report No. 29, dealing with the general theory of air screws, including propellers, fans, helicopter screws, helicoital pumps, turbo motors, and different kinds of helicoital brakes. This is a reprint from the Fourth Annual Report of the committee. George de Bothezat is the author.

Promoting Team Work Through the Ideal of Service

How one progressive employer has made a foundry look like a college campus and has carried out this same relationship with his employees in all his dealings with them. The plan outlined is practical and produces beneficial results for both employer and employee

CARRYING out in all their dealings with employees the clean frankness of spirit expressed in the pleasing and attractive physical appearance of their plant, the officials of a large western foundry company have come very close to achieving the ideal of practical industrial democracy. The flower gardens, the beautiful lawns, the attractively planned streets, and the pleasant working conditions of this plant are so extensively carried out as to be unique; but their real significance lies, not merely in their apparent helpfulness, but in the spirit behind them which extends throughout the more vital things such as wages, recreation, home-owning, and general service to employees.

The most apparent of the many striking features of this unique plant is the beautiful college-campus surroundings which have supplanted the usual dust and dirt of the ordinary foundry. The accompanying partial view of the plant of the Clark Equipment Co. tells the story more forcefully than any words.

Besides the attractive exterior of the building and layout of the plant, which rivals any park for beauty and restfulness to the eye, the working conditions within the buildings are kept at a high standard.

Sanitation and safety have been given special attention, so that the employee is enabled to devote his full energy to production without worry as to health or injury.

In furthering the ideal of real service to employees, this company, headed by Eugene B. Clark, has taken two important steps toward building good morale—a social activities plan, fostered by the company and operated by the employees, and a housing plan which enables the workman to own his own home.

One of the chief factors in the plan of recreational activities is the big theatre which has become the social center of the town. It is open not only to employees, but to all their friends and other inhabitants of Buchanan, the town in which the plant is located. Throughout the winter months, entertainment is to be found here practically every evening. Among the most popular of these entertainments are those given by the Clark Players, a remarkably able group of amateur thespians. Following the entertainments, dances are frequently held, while basket ball teams, recruited from the employees, play many thrilling games in the big auditorium.

The housing project of this company is not only highly desirable from the standpoint of the employee, but is an intensively practical conception. Forty-three homes, ranging in price from \$2,500 to \$4,500, were erected last year to aid in housing the 1,700 employees. The ideal of beautification was extended to the building of these structures, and the neatly groomed lawns, incipient shade trees, and well constructed sidewalks shown in the illustration prove the success of the attempt. These well constructed single houses—

homes in every sense of the word—were sold to employees on the basis of actual cost. The size of the initial payment demanded and of the monthly installments was regulated by the company with regard to each individual case.

Having thus provided for attractive surroundings, pleasant leisure hours, and opportunity to own a home, the company has carried their industrial democracy idea into the more practical and, perhaps, more vital field of money payments. Besides paying good wages, every employee is offered the opportunity to buy stock in the company. Great numbers of the employees have taken advantage of this offer and every stockholders' meeting sees many employees present.

To employees who own stock, an employees' profit-sharing certificate is given. This certificate entitles the holder to special dividends every year in addition to the regular stockholders dividend. The stock may be bought on a part payment plan which puts it within reach of practically every employee. Thus the employees are enabled to have a direct share in earnings which they have helped to create.

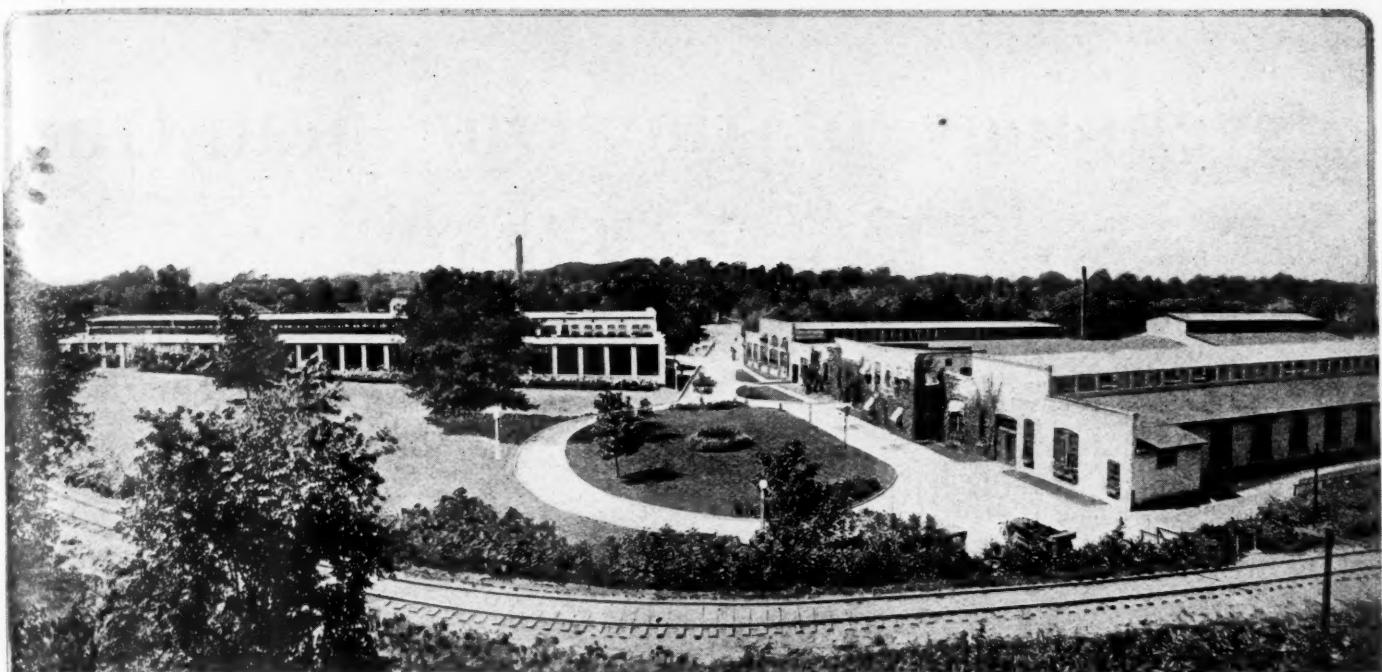
As the proof of the pudding is in the eating, so the success of any plan of industrial democracy must be measured by the results produced. That the Clark plan produces results is evidenced by the fact that during all the recent labor troubles this plant has always been fully manned and has had in its files a list of desirable applicants for employment. Production has been progressing satisfactorily and strike troubles are unknown.

To check the turnover is, of course, a major labor problem in every plant. In doing this, the Clark plan has been successful. This firm computes labor turnover by dividing the total number of employees leaving in any month by the average number on the pay-roll during that month. The annual turnover is found by adding the figures for each month. The index figure so reached for 1917 was 118.50, for 1918, 118.6, making an average for the two years of 9.88 per month. For the first half of 1919, however, the monthly figure was 7.6; of this 2.3 was desired by the company.

The stockholders' meetings bring out free discussion from the employee stockholders and eliminate the possibility of employees feeling that the management is keeping secret any of the policies or plans of the organization.

The plant is operated ten hours a day and the employees as well as the management approve of the arrangement. E. B. Clark, the president of the company, states that if a vote on this question were taken at the next stockholders' meeting there would be no inclination to shorten these hours.

It is refreshing to find again an organization which is proving, not only in theory but in practice, that honesty and justice, as the cornerstones of industrial relationships, form the firmest foundation possible for dealings between employer and employee.



A foundry—not a park—where production is high, and the workers own their homes. Partial views of the plant and townsite.



Psychology of the One Man-One Job Problem

The one man, one job problem is familiar to all factory managers, but Mr. Tipper recently has realized that there is one phase of this study that has not been generally appreciated. In this article he takes up this side. Briefly, it is putting before the employee an opportunity to gain knowledge of the product, as well as relief from the monotony of work

By Harry Tipper

FROM time to time in these articles, reference has been made to the one man, one job method of industrial organization. It has been pointed out that the limitation of the workers activities, to one type of work, and the classification to agree with the increasing sub-division of machinery, is not based upon any extensive analysis and has grown up without any serious attempt to question its value.

Although some of the types of work in industry today are so limited in the number of physical motions and mental reactions required, that it is possible to secure proficiency in a few days, the effect of such a limitation of activity upon the mentality and physique of human beings has hardly been discussed. Ruskin's antagonism to machinery, which was attributed to his individualism and laughed at by contemporaneous writers, was not without reason. His fear of the dominance of the machine would be vastly increased if he could examine the productive activities of today, read the history of production organization and observe how thoroughly the study of the mechanical side had engrossed the minds of the engineers and factory executives to the exclusion of the human necessities.

The reason for this classification of people in accordance with sub-division of machinery, is to be found in the ease with which an organization of this type can be constructed and the smaller amount of intelligence and analysis which is required for its proper control. It takes a great deal more thought, a much deeper study and a much more careful analysis of functions and relations to determine the changes which should be made in a man's work, in order to fulfill his psychological necessities.

Industry has paid no attention to psychology, and has proceeded as though human beings could change their fundamental necessities according to circumstances, instead of realizing that the slow process of human development is a change in the surrounding circumstances, created by human beings for the purpose of producing a social organization that is more thoroughly in accord with psychological requirements.

In the last year or two, a few industrial managers, here and there, whose intuitive capacity is much greater than the expressed knowledge of psychology, have been wise enough to see the necessity for increased activity in the individual and for related work in the development of individual production. These men have been bold enough to put their ideas into experiments, so that there are a number of cases in individual departments of factories where the machine equipment has been modified to suit the human requirement and the character of the work correspondingly changed.

An electrical manufacturing company in Philadelphia has succeeded in changing the whole character of manufacturing

operation in connection with the manufacture of connectors.

Under the original system the manufacture of these connectors was accomplished by ten different operators handling ten different types of machine operation. The production is very rapid and the work highly repetitive, so that the mental and physical activity required for the individual operation is confined within very narrow limits.

CHANGING THE WORK

Today in this electrical concern, every operator making connectors does every operation connected with that manufacture in the order in which they are required for the assembly, and after they have done these operations they assemble and test the same connectors. For instance, an operator will start on a batch of connectors and follow them through each individual operation, assemble them and test them. By these means, several things are accomplished in the development of the worker and several production disadvantages are eliminated.

FIRST—There is provided a constant understanding of the objects of each operation, because the result of each operation affects the assembly and determines the test. The reason for accuracy and quality of workmanship in each operation is indicated, and the value of care is established by the necessity of assembling the pieces from each operation and the necessity for testing these assemblies.

SECOND—The change of motion and position required for each operation provides the mental and physical variation which is necessary to a balanced development and the elimination of continued fatigue. Monotony is not established because of the simplicity of an operation, but because of the continued repetition of this operation without apparent end and without change.

THIRD—It develops an incentive in connection with the work, because of the larger importance of the result of the work. No human being can retain an incentive to continue at work where the object remains insignificant or cannot be seen by the operator.

Mr. Gilbreth related a story years ago about placing a pile of bricks in one corner of the yard and getting a worker to move them to another by loading them in a wheel-barrow. When he tried to get the man to move them back, the worker refused. He could see no object in merely transferring the bricks from one point to another and taking them back again.

It is getting increasingly difficult to secure workers for the jobs around a manufacturing plant, where the object is insignificant. This electrical company has succeeded by its methods in establishing the importance of the object

in the cause of each operation undertaken by the operatives.

FOURTH—The incentive to produce is maintained in this case, because of the importance of the object and the physical value of the product and as a corollary to this the quality of the work and the rapidity of the work are both increased. In addition to these benefits, the result upon the cost sheet has been to reduce the cost per operation, to reduce the rejected percentage, to reduce the inspection necessary, and increase the production per operative per hour.

Any psychological student will understand the logic of gathering related work together and working it in cycles instead of sub-division. At first glance, such a change appears to involve a complete reorganization with its attendant confusion and difficulty.

If the manufacturer attempted to rearrange his whole plant at the same time, confusion would result and disorganization take place. In every plant, however, there are operations which in themselves are more repetitive, more monotonous and more insignificant than others, and these are the operations which present the greatest problem. In every plant these operations relate themselves in cycles, which complete a definite operation of the work and it is in the study of these related cycles into which each subdivision enters that the organization changes and can be made successful.

DISREGARDING THE INDIVIDUAL

In building the machine industry which we have created in the last fifty years in this country, we have been satisfied to produce enormous quantities by massing people together in classification without paying any attention to the position of the individual and the effect of his work.

Seventy-five years ago, the man who was a cabinet maker learned a great deal about lumber because he chose his own wood, and he chose different wood for different kinds of work, because of its applicability to those particular requirements. He learned how to conduct a great many operations in order to make all the different parts, how to fit them together and produce the finished product.

He lived in a society less well informed, less intelligent than the society of today. He could not be accused of being further

advanced in civilization than what we are, and yet his logical successor is turning chair legs in a furniture factory and his mental activity and physical proficiency are limited to that operation. This is individual advancement in a backward direction, and no matter how much we may have increased the total volume of production, no matter how much machinery we have been able to erect, so long as the industrial organization continues to sub-divide its operation and classify its workers according to this sub-division, so long will it continue to demoralize the mentality of its workers and increase the rebellion against that mental servitude.

VARIATION PROVIDED

It is fortunate that many of the operations required in the metal trade provide sufficient variation in themselves and a sufficient important object in themselves, to permit of a higher mental activity. We have called the machinist trade one of the most skillful trades. Just as much skill is required in many other lines, but the variation is lacking; the work has been sub-divided so that the object is insignificant and as a consequence, the intelligence of the worker is decreased.

In the automotive field, the standardization of production has been carried much farther than in any other metal industry, the sub-division of operations has been carried to a very much greater degree and as a consequence the automotive field has a higher amount of highly repetitive work with an insignificant object in the actual operation.

It is not good that this condition should exist and material improvement in production in these departments cannot be expected, until the character of the work for the operator has been changed sufficiently to enlarge his mental necessities and increase the significance of the object of his skill.

It is one of the new elements of study, which the future manager of production must begin to undertake. Psychological knowledge and the study of the individual in relation to his object are the most important matters involved in an industrial organization of today and the future. Neither of them has had any part in the curriculum of the industrial education nor in the studies of the industrial activities. They must be recognized as fundamental necessities, in order that the organization requirements may be met with the least possible difficulty.

Researches on the Operating Conditions of Magnets

(Continued from Page 1221)

At high speed (2,500 and 3,000 r.p.m.) when the spark takes place in free air, there will be observed on the oscillograph a considerable diminution of the current in one of the spark waves, which may go so far as to suppress that spark. This irregularity may occur indifferently in one or the other of the waves. The explanation of the phenomenon is as follows:

The spark is of relatively long duration, which at high speed may be as great as one-half the total duration of the wave. By referring to Fig. 4 it will be seen that the secondary is in full discharge at the moment the primary circuit is closed.

The closing of the primary circuit tends to diminish the secondary current. The same phenomenon is reproduced here, but as the secondary circuit is closed by the spark, which is an unstable conductor, this diminution entails immediately the sudden interruption of the spark. As a matter of fact, the oscillographic plates show a sudden cessation of the secondary current.

The abrupt variation of the corresponding current acts exactly as in the phenomena previously investigated, as regards retarding the rise of the primary current which produces the next following spark. The second spark, which for this reason will be of reduced intensity, does not react on the third, which, in consequence, is similar to spark No. 1, and so on, which explains the general nature of the phenomenon affecting one wave.

There is another fact to show that the abrupt break of the secondary circuit coincides with the closing of the primary; it frequently occurs that a small parasitic spark grafts itself upon the main spark at high speed; this spark is always preceded by a sudden drop of the secondary current. If the arrangement of the break be observed at this moment, there will be seen four declivities of sparks corresponding to the break and the make of the primary current. In suppressing the parasitic spark, either by adding a high resistance to the secondary, or by blowing out the spark, it will be noted that the two declivities of sparks corresponding to the closing of the primary circuit disappear.

Finally, by blowing the spark by a strong air current, which greatly reduces its duration, the operation of the magneto will be steadied and the irregularities will be completely prevented.

It has also been found that a resistance of several thousand ohms steadies the phenomenon. This resistance deforms the current of the spark. As regards its exact determination, the remarks made in connection with the phenomenon previously discussed are applicable in toto.

One is thus led to study the nature of the spark, and, in particular, to see in what proportion the secondary, acting as a generator itself, discharges into the circuit closed by the spark. This phenomenon has been observed for lengths of spark up to 0.15 in. (normal spark gap, atmospheric pressure.)

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

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Combination in the German Automobile Industry

SHORTLY after the signing of the armistice, one of the leading men in the German automobile industry, Doctor Allmers of Bremen, issued a pamphlet entitled: What the German Automobile Industry Needs. In this he advocated that automobile manufacturers should get together, either entering all into a single large combine, or else forming a number of groups, arranging matters so that each factory would manufacture only one or at most two different models, and these in large numbers. He further advocated the use of the best and most modern manufacturing methods, the adoption of those methods in which the American industry excelled, and maintenance of quality of product.

When it was attempted to put the suggested plan into practice, it was found impossible to bring all of the factories into one organization. Even in the formation

of groups numerous obstacles were at first met with, though the interested parties were convinced that this was the only way the desired results could be achieved, and also that the period of grace during which the low rate of exchange would assure protection to the German industry should be taken full advantage of.

A beginning in the amalgamation of German automobile concerns was made recently, when the following three firms got together and agreed that a definite manufacturing plan, including the manufacture of bodies; National Automobile Co., of Berlin, a subsidiary of the German General Electric Co.; Hansa-Lloyd Works of Bremen and Brennabor Works of Brandenburg on the Havel. The organization is known as the Community of German Automobile Works and has its headquarters in Berlin. It is expected that other firms will join in the future.

Wave Transmission

THERE have been constant onslaughts on the position of the geared transmission ever since it was first introduced in automobile practice. The geared transmission has the disadvantage of a certain lack of flexibility, as at best only a relatively small number of gear changes can be obtained. Moreover, the method of obtaining changes of gear by meshing toothed wheels laterally while in motion has long been decried as unmechanical.

A radical departure in methods of power transmission on automobiles is at present being promoted in England in a somewhat peculiar way. The inventor is a Roumanian, George Constantinesco, who made a name for himself during the war by inventing the Constantinesco or CC firing gear for synchronous machine guns firing through the propeller. Mr. Constantinesco's transmission system is known as a wave transmission and consists in giving a pulsating motion to a quantity of liquid contained in piping and using the kinetic energy of the liquid to operate a motor. No description of the mechanism used for creating and utilizing the motion of the fluid is given in the prospectus. Attention is called, however, to the sharp difference between wave transmission and ordinary hydraulic transmission, which latter involves a continuous flow of liquids in a closed circuit, and it is asserted that wave transmission is analogous to alternating current electrical transmission in which the currents change direction at short intervals.

The reason for the success of the alternating current system of electric transmission is that with alternating currents transformations from low voltage and high amperage to high voltage and low amperage, and vice versa, can be made with very simple apparatus and very little loss. This is of value because high voltage is absolutely necessary for economical transmission over long distances, whereas low voltage must be used at points of consumption for the sake of safety. The same might apply if power were to be transmitted hydraulically over long distances. On an automobile it is not a matter of long distance transmission, but rather of ready conversation from high pressure and slow motion to low pressure and fast motion vice versa. Just how Mr. Constantinesco's system would permit of transforming

speed and pressure is not clear. This is readily accomplished—at least theoretically—by means of the ordinary hydraulic system, still this system has not proven successful in automobile work, on account of what might be described as mechanical or constructional difficulties.

It seems to us that a more logical parallel to wave motion than alternating currents is to be found in Tesla's oscillator, which was to replace the rotary electric generator. The argument was that in the common electric generating plant the reciprocating motion of the engine piston was unnecessarily transformed into rotary motion, as no particular kind of motion was necessary for generating currents. Tesla had become world-famous through his invention of the rotary field electric motor, the first alternating current motor self-starting with considerable torque. But his oscillator never became a commercially practicable machine.

We do not know sufficient of the details of wave transmission to warrant us in condemning it outright, but it is certainly difficult to see the advantage for transmission over short distances of transforming a rotary motion into a reciprocating motion and then back into a rotary motion. Or can it be that Mr. Constantinesco contemplates using directly the reciprocations of the engine piston for imparting a pulsating motion to the fluid?

Price of French Cars

DISCUSSING the apparently high prices which are being asked by French manufacturers for their cars, C. Faroux makes the statement, in a recent issue of *La Vie Automobile*, that, as compared with 1914, the prices of French cars have only about doubled, whereas the cost of raw material and the manufacturing cost have approximately trebled. He says the manufacturers are able to sell their cars at a price relatively lower than in 1914, because war work enabled them to write off most of their old equipment. The machine tool equipment has been improved, and the working organization is better than it was before the war. Besides, the manufacturers are content to lose some of their war gains.

Courage of Conviction

THREE is something inspiring about the courage of a company which will frankly put its car on test before the eyes of the world and permit the reputation of the car to stand or fall by the results accomplished in such a test. This accomplishes two things for the concern which did it. First, if the test is successful, it will help sell cars because of the added reputation the car will gain. Second, whether the car succeeds or fails, it will teach valuable lessons to the engineering department, assisting them in improving the product and thereby raising the standard of this concern directly, and of the entire industry indirectly.

Experimental departments often take a car out over the road in an endeavor to break it up for the purpose of learning what lessons can be learned in this manner.

This is very valuable, but it is at best a chassis test rather than an engine test. Furthermore, it is a test which is witnessed only by the engineers of the particular concern interested. A test of the kind recently run on one of the prominent speedways, where a concern placed its product under the observation of an unbiased body and gave it what might be termed a break-down test, is more thoroughly a criterion of what the engine will do. Such courage is to be commended because it accomplishes results which tend toward the improvement of not only that particular product, but of automobiles in general.

Skeletonize the M. T. C.

IF the Motor Transport Corps would skeletonize its organization it might win the necessary appropriations and approval from Congress to assure its perpetuation.

Under existing conditions it is most certain to find Congress antagonistic.

It is too much like a car trying to make a steep, slippery grade on high. Congressional determination to reduce the national expenditures is a steep, slippery, almost unsurmountable obstacle. The M. T. C., operating a huge personnel and numerous posts, is attempting to run on high.

Congress will not revise its notions about finances. The M. T. C. must get into low or be ditched.

It would be most unfortunate if no compromise is undertaken. As a logical, efficient and reasonable proposition, the existence and perpetuation of a Motor Transport Corps in the U. S. Army with coordinated control of Army trucks, cars and motorcycles, cannot be questioned.

Magnetic Analysis

IT IS becoming increasingly apparent that some non-destructive method for the testing of steel and steel products is urgently needed to supplement the present methods of vicarious testing. The Magnetic Laboratory of the Bureau of Standards has for some time past been investigating the possibility of utilizing the magnetic properties of iron and steel as indications of mechanical properties. The results already obtained indicate the possibility of applying magnetic methods to the study of the structure and properties of steel and to the testing of raw material and finished products. This application of magnetic testing has been termed magnetic analysis.

The present work of the laboratory consists of a study of the correlation between the magnetic properties of steel and its structure and mechanical properties, and the development of methods and apparatus for the application of magnetic analysis in a practical way. A method has already been developed for the determination of the degree of homogeneity along the length of a relatively long piece which is being used by at least one railroad for research on rails. This method for detecting flaws and defective material is being extended to other uses.

MERCER PRESIDENT TO HEAD LOCOMOBILE

Reorganization Plans Include Production of Lower Priced Cars and Trucks

NEW YORK, Dec. 15—In connection with the announcement of the reorganization of the Locomobile Co., of America, announcement is made today of the selection of Emlen S. Hare, president of the Mercer Motor Co., to head the new company, which will be known as the Locomobile Co.

Associated with Hare will be O. E. Hunt, H. S. Church, Henry Lansdale and C. L. Guyman, who until their recent resignations from the Packard Motor Car Co., held positions there of chief engineer of motor cars, chief engineer of motor trucks, car sales manager and Government distribution manager, respectively.

The new Locomobile company proposes to add to its present passenger car, a medium sized and lower priced Locomobile, which will not, however, compete with the Mercer car. In addition the company intends to build a line of trucks ranging in size from $\frac{3}{4}$ ton to 5 tons capacity. At present Locomobile makes only a 4 ton truck.

Authorized capitalization of the new corporation will be 300,000 shares of no par value common stock and \$5,000,000, 7 per cent cumulative preferred stock (\$100 par), of which 200,000 shares of common and \$3,500,000 of the preferred stock will be issued at once. The authorized bonded debt will consist of \$2,500,000 first and refunding mortgage 6 per cent bonds, due 1935, of which \$1,416,000 will be outstanding.

The Mercer Motors Co., will, subject to the approval of its stockholders, acquire a substantial block of common stock of the new Locomobile company and will take an option to purchase 100,000 shares of common at \$35 a share. This will make Mercer Motors the largest individual holder of Locomobile common and will eventually enable it to acquire control.

Net profits of the Locomobile Co. of America for the year ended June 30, 1919, were \$1,249,823, after depreciation and taxes. The balance available for common on the basis of the new capitalization would be \$930,000 or \$4.65 a share.

Pneumatic Tires on New Packard Trucks

NEW YORK, Dec. 21—Pneumatic tired trucks, designed to meet the demand for greater speed and wider range in truck transportation, are announced by the Packard Motor Car Co. for 1920 production. These new models are the first pneumatic tired trucks to be manufactured by the Packard company, and

are distinct in design from the solid tired truck models.

The trucks are built in three different sizes, giving a large range in capacity. The fact that they are specifically designed for pneumatic tires is a long step in the application of the motor vehicle to special work, according to T. H. Smith, manager of the transportation engineering department of the Packard Motor Car Co., of New York.

Allege Tire Co. Cited as Unfair Competitor

WASHINGTON, Dec. 16—The Federal Trade Commission has cited the Super Tread Tire Co., of South Bend, Ind., in a formal complaint, alleging unfair methods of competition. The respondent has forty days in which to file answer after which the case will be tried on its merits before final settlement.

It is alleged that this company engaged in the practice of purchasing old and discarded tires, of repairing and coating the same with rubber coating and offering these tires for sale to the public, as tires made from new and unused material. The complaint also alleges in its advertisements the respondent company concealed and failed to disclose that its tires are remade and rebuilt, and that the effect of such practices was to mislead the public.

Experts Favor Govt. Aeronautical Dept.

WASHINGTON, Dec. 13—Creation of an aeronautical department of the government to co-ordinate all aerial activities was urged upon Congress recently by five American aces credited with having brought down more than fifty German airplanes. They were testifying before a subcommittee of the House committee investigating war expenditures.

Recommendations made during the hearing included establishment of a national flying academy, government subsidies to manufacturers and preliminary training of Army and Navy fliers under the same system.

The committee expected to conclude hearings Monday and start work on framing a bill.

Lincoln Officials in Chicago Names

CHICAGO, Dec. 13—H. M. Allison, former president of the Packard Motor Car Co. of Chicago, and Lewis E. Rood, formerly associated with Dodge Brothers, have been appointed Chicago distributors for the new Lincoln Motor Co. It is understood the Lincoln companies have thirty-one applicants for the Chicago territory and that the local distributors have been promised a considerable percentage of the total output for the Chicago field.

FORM AXLE CO. WITH \$5,000,000 CAPITAL

Eaton Company Plans Output of 30,000 Sets in First Year

CLEVELAND, Dec. 17—Announcement has just been made here of the formation of the Eaton Axle Co., which is capitalized at \$5,000,000 and will manufacture axles in this city. In addition to Otis & Co., bankers, the company is backed by The Guardian Savings & Trust Co., and the First National Bank, two of the largest financial institutions in Ohio.

The new factory will be built on fifteen acres adjacent to the New York Central railroad near East 140th street. The first unit of the plant will be erected shortly and will be one story, saw tooth type construction and will give about 150,000 sq. ft. for production.

Plans called for the production of 30,000 sets of axles the first year, with that production doubled the second year and tripled the third. The value of the first year's production is estimated at \$8,000,000.

COMPANY OFFICERS

J. O. Eaton, president and general manager of the new company formerly was president of the Torbensen Axle Co. Associated with him in the new enterprise are V. V. Torbensen, inventor of the Torbensen internal gear drive for trucks, who will be chairman of the board; O. I. Ochs, vice-president in charge of sales and purchases, who held a similar position with the Torbensen Co.; C. F. Hepburn, another vice-president; F. A. Buchda, formerly with Torbensen, treasurer, and R. C. Hyatt, secretary.

The new company will have on its payroll, H. G. Weymouth, factory manager, and A. F. Kroesen. He formerly was general superintendent of Torbensen, while Mr. Kroesen has been in the employ of the Timken Axle Co.

Plans by company executives provide for the manufacture of the new axle in such quantities that cars and trucks may be equipped by July 1. The company will make a passenger car type axle of beveled gear drive and a commercial car axle said to be a marked advance over previous designs. This is of the internal gear type but with all gears operating in oil.

SIOUX CITY IN ANNUAL "POW-WOW"

SIOUX CITY, IOWA, Dec. 15—Every city and town in Sioux City territory was represented at the annual convention of the Sioux City Motor Trades Assembly. Included in the 950 automobile men present were dealers and garage men and men from every branch of the retail field.

BRITISH WOULD USE LIBERTY ENGINES

Airplane Manufacturers Find Domestic Engines Too Costly and Scarce

WASHINGTON, Dec. 15—British aircraft manufacturers are desirous of obtaining Liberty airplane engines from the United States, according to reports received here. It is apparently important at the present time for the companies to secure the engines through the British Air Ministry and it is believed that if agencies are established in England for Liberty engines by manufacturers, there will be a considerable demand for them.

For the same class of work for which the Rolls-Royce Eagle VIII, the Napier Lion or other engines of this type are used, the Liberty engine is very highly considered, and many of the commercial aircraft companies in England like it fully as well as the Rolls-Royce.

The Rolls-Royce engine is so costly and so difficult to obtain in sufficient quantities that the commercial aircraft companies cannot seriously think of employing it. The Napier Lion is more expensive than the Rolls-Royce and it is believed that neither of these engines will be materially reduced in price for a considerable time to come. The Rolls-Royce Co. has the reputation of deliberately keeping their prices high for reasons of their own, and it is said that the Napier Co. does not wish to reduce the prices of their engines below that of Rolls-Royce.

Among the companies that have specially signified their desire to obtain Liberty engines may be mentioned the British Aerial Transport Co., Ltd., and the Westland Aircraft Engineering Co., Ltd.

Carolina Show in Week of Feb. 9-13

CHARLOTTE, N. C., Dec. 16—The Charlotte Automotive Trade Association will hold an automobile show to be known as "The Show of the Carolinas," Feb. 9 to 13. The show committee is composed of Lee Folger, chairman; James Taylor and Joseph G. Fizsimons, and the sub-committee of Osmond Barringer, W. V. Wallace, W. T. Hoppe and Julien Herndon.

Stutz Sales Show \$3,000,000 Increase

NEW YORK, Dec. 13—It is reported in financial circles here that net sales by the Stutz Motor Car Co., Indianapolis, for 1919 will reach \$7,500,000, an increase of more than \$3,000,000 over the best previous year.

The full capacity of the plant is contracted for, according to the report, up to July, 1920. Additional plants, expected to double the output of the company, are to be ready and in full operation early next year.

With net profits for the six months ending June 30, 1919 of \$653,742, after all charges, but before Federal taxes were deducted, and earnings during the current months about the same, the net profits for the year after Federal taxes, is expected to reach \$1,125,000.

Publication of this issue of Automobile Industries has been delayed until Jan. 1 by conditions over which the publishers have had no control. Further issues will be forthcoming as rapidly as they can be printed.

Studebaker to Have Brooklyn Station

NEW YORK, Dec. 16—The Studebaker Corp. announced today plans for a \$250,000 retail building in Brooklyn, on which work will be started in the near future. The structure will be five stories, and will be patterned after the Ford building on Broadway, New York. It will be located on Bedford avenue.

The New York Studebaker sales-quarters will be moved May 1 to Broadway and West Fifty-fourth street. Leasing of the present Studebaker quarters at Broadway and West Fifty-seventh street by the Paige necessitates the removal.

Ford Wins Permit to Build in Spain

WASHINGTON, Dec. 13—Permission has been granted to the Ford Motor Co. to construct an assembly plant at Cadiz, by the Spanish government, despite protests by the Hispano-Suiza Co. and the Spanish National Association of Metallurgical Industries, according to a report received by the Bureau of Foreign and Domestic Commerce.

Protests were disallowed because it was argued the Ford company would employ 1,000 workers, increasing the prosperity and development of the country and Cadiz, adding to the Spanish export trade, and further, because the Ford automobiles do not compete with those manufactured by the Hispano-Suiza Co., which are distinctly cars of expensive types.

The Ford company expects to put machinery into the establishment in the near future and be actively building cars by Jan. 1, 1920.

Tractor Show in Permanent Site

KANSAS CITY, MO., Dec. 15—For the first time in the history of the national tractor shows, the 1920 exhibit, scheduled for Feb. 16 to 21 inclusive, will be held in a permanent structure with more than four acres of ground space available for display. Reservations for the show are going rapidly and every indication points to the greatest show of all. The new building is indicative of the change in thought since the first show was held in 1916. In that year the Kansas City Tractor Club, originator and director of the shows, held the first exhibit in a circus tent. This was such a success the es-

Propose Air School on West Point Plan

WASHINGTON, Dec. 13—A national air academy, similar to West Point, has been recommended by Col. T. D. Milling, of the military air service, as the best and most economical method for training aviators for use in commercial pursuits and during war.

"Continuous operation of planes is the only way to keep the personnel of the service in trim," Colonel Milling told the House subcommittee on military affairs, urging a merger of the training departments of the Navy, Army and Civil Air branches.

STERLING PRICES RISE

RUTHERFORD, N. J., Dec. 13—Prices of Sterling tires and tubes will advance Jan. 1 from 10 to 20 per cent, dependent on developments in the cotton and rubber markets, according to an announcement by the Sterling Tire Corp., today.

Increased costs of fabric and cord, rubber and labor, are given as the impelling causes of the advance. The announcement furthermore predicts that even with general increases in prices of all tires, there will be a market shortage owing to the undersupply of cord fabric.

START MEXICAN SERVICE

WASHINGTON, Dec. 15—An international commercial airplane service, operating an aerial mail and passenger line from Southern California points across the border to Mexicala and other Lower California cities, has been launched by Capt. T. C. Paine of Riverside, Cal., permission having been granted by Secretary of State Lansing and the Governor of Lower California. The franchise requires that all passengers be forced to show passports before boarding the planes, and that landings be made only in the presence of Federal immigration or customs inspectors.

ARRANGE PROGRAM FOR TRAFFIC MEET

Three Sessions of National Highway Traffic Association at Chicago Convention

ANN ARBOR, MICH., Dec. 15—Many interesting subjects are set down for discussion at the convention of the National Highway Traffic Association, at the International Amphitheatre, Chicago, Jan. 29, the program of which was announced today by Arthur H. Blanchard, president.

For the morning session the program is:

Report of committee on "Highway Transport Franchises," chairman, F. W. Fenn, secretary of the motor truck committee, National Automobile Chamber of Commerce.

Report of committee on "Interrelationship of Highway, Railway and Waterway Transport," chairman, Professor Henry E. Riggs, University of Michigan.

"Effect of Car Trucks on Traffic Capacity of Roadways," by George W. Tillson, consulting engineer, La Grange, Ill.

Report of committee on "Traffic Limitation Strips on Roadway Surfaces," chairman, C. W. Hubbell, city engineer of Detroit.

Report of committee on "Sign Posting for Detours and Through Routes in Municipalities," chairman, Elmer Thompson, secretary Automobile Club of America.

The afternoon program:

Joint session of Highway Transport Conference of the National Automobile Chamber of Commerce, and the National Highway Traffic Association.

Subject: "Highway and Motor Transport."

"Taking an Interest in Motor Truck Legislation," by Harry Maxwell, Jr., secretary of Automotive Industries Legislative Commission, New York.

"Value of Highway Transport Surveys," by F. Van Z. Lane, transportation engineer, Packard Motor Car Co.

"Interrelationship Between Highway Transport and Back-to-the-Farm Movement," by R. C. Hargreaves, manager of Detroit branch, B. F. Goodrich Rubber Co.

The evening program:

Joint session of Highway Transport Conference of the National Automobile Chamber of Commerce and the National Highway Traffic Association.

Subject: "Highways and Motor Transport."

"Relation of Highways to Motor Truck Operating Cost," by Arthur H. Blanchard, professor in charge of Highway Engineering and Highway Transport, University of Michigan.

"Progress in Highway Improvement," by William G. Edens, president, Illinois Highway Improvement Association.

"Constructing Roads for Motor Truck Traffic," by T. R. Agg, professor of Highway Engineering, Iowa State College.

"Status of Legislation Relative to Snow Removal from Inter and Intra-state Highways," by Raymond Beck, chief, Goodrich National Touring Bureau.

Organize Company to Make Astra Car

ST. LOUIS, Dec. 15—The Astra Motors Corp. has been organized with B. R. Parrott, formerly director of advertising and sales of the Inland Machine Works, president and treasurer; A. J. Kessinger, vice-president of the Newsom Valve Co., secretary; V. C. Kloepfer, chief engineer. The company will manufacture in St. Louis the Astra car, designed by Andre Mertzanoff, a New York engineer. Offices have been opened in the Syndicate Trust building, and the factory of the One Wheel Truck Co. will be used temporarily.

Standard units will be used to assemble the car here, where the body will be made. The car will be sold for about \$1,400. LeRoi four-cylinder engine, Borg & Beck clutch, Zenith carburetor, Flint front axles with Timken bearings, Simms magneto and Westinghouse two-unit starting and lighting system are some of the units that will be used.

The Astra concern has a production contract at cost plus 25 per cent with the Associated Motors Corp. of New York, originators of the car, for 3,000 cars in 18 months, beginning Jan. 1, Kessinger said.

FAVOR TOWNSEND BILL

WASHINGTON, Dec. 13—The Mississippi Valley Association, in annual session here, passed a resolution to Congress in line with the principles embodied in the Townsend bill now pending, looking to the enlargement of the Bureau of Public Roads into one of the most active branches of the federal government.

START TRACTOR PLANT

MINNEAPOLIS, Dec. 16—Einar Hoidal, treasurer of the Magnet Tractor Co., announces work started on the first of three units to be built on a six-acre tract at Eighteenth and Central avenues at a cost of \$40,000. The second unit, twice the size, will be started in the spring. The company has been incorporated with \$500,000 capital. Officers are, president, R. A. Jacobson; vice-president, M. T. Benson; treasurer, Einar Hoidal; directors, Dr. C. H. Kohler and C. J. Hedwall. The company already has large export orders.

NEW FOUNDRY PLANNED

NEW YORK, Dec. 15—The Haywood Foundry Co., backed by interests in the Haywood Tire & Equipment Co., Indianapolis, is to build a factory there for the manufacture of gray iron.

1919 Eastern Rubber

Crop 360,000 Tons

NEW YORK, Dec. 15—Aggregate production of eastern crude rubber for this year is placed at 360,000 tons, of which 320,000 tons will be of the so-called plantation grades, and 40,000 tons will be wild. This figure, according to a report rendered to the Department of Commerce by Alfred Nutting, clerk in the American Consulate General of London, was announced by the chairman of a well-known British rubber concern at its recent annual meeting.

"The United States has imported more than 150,000 tons during the first eight months of the current year, and the total for the twelve months will aggregate 220,000 tons," the report states. "Against this the United Kingdom has imported only 40,000 tons, which is estimated to meet the year's consumption. France took 14,500 tons in the first six months and for the year may need 30,000 tons. Italy's requirements are estimated at 15,000 tons; Canada, 10,000 tons; Japan, 10,000 tons, and 25,000 tons for the rest of the world."

"This would make," the report concludes, "a total consumption of 350,000 tons, against a production of 360,000 tons in the current year."

Changes at Singer

Factory Announced

NEW YORK, Dec. 18—The Singer Motor Co., Inc., of Mount Vernon, N. Y., maker of custom built cars, has announced a change in organization.

John O. Ekblom, formerly with the R. & E. Motors Co., recently was elected president; G. Arnold Dimond, for many years president of the Singer company, was elected vice-president, and Evans R. Dick, president of the Stamford Brass Rolling Mills, was chosen chairman of the board of directors. James W. Sloat is secretary and salesmanager, and F. S. Ambrose, treasurer and engineer.

The Singer company recently moved to a new factory in Mount Vernon. The plant is being used as the general offices and assembly shop, all road tests and experimental work being done there. The body and trim work is completed at the factory in West Forty-seventh street, New York.

TRUCK PRICES ADVANCED

PONTIAC, MICH., Dec. 13—Prices of trucks manufactured by the General Motors Truck Co., at Pontiac, have been increased recently as follows:

M-16	$\frac{3}{4}$ to 1 ton	\$1,595
31	$1\frac{1}{2}$ to 1 ton	2,500
41	2 to 1 ton	2,950
71A	$3\frac{1}{2}$ to 1 ton	3,950
71B	$3\frac{1}{2}$ to 1 ton	4,025
101A	5 to 1 ton	4,550
101B	5 to 1 ton	4,625

BRITISH ENGINEERS TO ADOPT STANDARDS

Views of American Tool Gage Exporters Will Be Sought on Limit Gaging

LONDON, Nov. 18—(Special Correspondence)—It is now widely known that the British Engineering Standards Association has had under consideration for some time past the question of a standard system of limit gaging for plain cylindrical work applicable to engineering generally. The sub-committee on Limit Gages has decided to recommend the adoption of the hole basis, and is hoping to settle shortly the important question of tolerances with regard to the nominal dimension.

Two methods have been proposed: (1) That the mean dimension of the hole should be its nominal size, the tolerance being both positive and negative; (2) that the minimum dimension of the hole should be the nominal size, the whole tolerance being positive.

From enquiries which have been addressed to a number of engineering firms throughout the country it appears that opinion is divided as to which method should be adopted. The question, it is hoped, may be finally discussed in a few weeks' time by the sub-committee.

Though addressed to British firms only, there is little doubt that views of American tool-gage firms doing business with Great Britain would be welcomed by the Secretary of the British Engineering Standards Association, 28 Victoria street, Westminster, S. W. 1.

—Englishman.

Profiteering May Halt Detroit Show

DETROIT, Dec. 15—Housing the 1920 automobile show is a problem that is giving the Detroit Automobile Dealers' Association much concern and President A. L. Zechendorf admits frankly they are "up in the air." It all reverts to the old story of the trend of the times and the penchant of the profiteer for "getting it while the getting is good," which has characterized American business since Pershing started over to stop the fuss.

The building used last spring at a rental of something over \$26,000, increased in value so rapidly, the association representatives were informed, when they sought to re-lease it, the rent would be \$50,000. Conscious of the trend of rent increases, the committee was prepared to pay \$35,000, but the price set staggered them. The directors took the position they would rather abandon the show than submit to what they termed extortion.

Erecting a new building in time, given serious consideration, was found impossible and a still hunt for a loca-

tion since has been conducted with little success. Two buildings suitable for the big exhibition are available, but almost prohibitive conditions and stipulations eliminate them from consideration. The Ford building at Woodward avenue and Grand boulevard is looked upon as an ideal location if arrangements can be made with the lessors. At all events the directors plan to put on the show on a scale of grandeur that will compare favorably with the New York and Chicago exhibit, making up in interior adornment what may be lacking in location. The location and dates will be announced within the next ten days. Meanwhile plans for purchase of a site and erection of a mammoth building to house future shows are progressing and the association expects to hold the 1921 show in its own home.

Showrooms Dark Before Order Comes

NEW YORK, Dec. 17—The automobile industry led all others in New York in observance of the light curtailment regulations growing out of the coal shortage. Without waiting for definite instructions from the city fuel administration, which itself was in doubt as to the rules to be enforced when the national order went out the first of the week, branch managers and dealers on Broadway "doused" showroom and window lights at 6 p. m., and eliminated all forms of decorative lighting, which had been used generally from about 4 or 4:30 p. m. on through the evening.

Ballot Car Coming for American Tests

PARIS, Nov. 28—(Special Correspondence)—The 8-cylinder Ballot car with which René Thomas broke the Gaillon hill climbing record was shipped to New York this week. It is understood that this car, which has a maximum speed of 125 miles an hour, will be made use of for establishing straight-away records in America. No driver is being sent from France, it being understood that some American will be put at the wheel of this car. The 8-cylinder Ballot is one of the machines which ran in the last Indianapolis race. It has since been modified by the fitting of a special streamline body, thus making it suitable for fast work on track or beach.

QUINCY SHOW IN FEB.

QUINCY, Ill., Dec. 8—The Quincy automobile show will be held Feb. 10 to 15 and dealers who will take part are confident of a record-breaking exhibition.

MONTANA SHOW SET

GREAT FALLS, Mont., Dec. 8—The Montant Automobile Show will be held in Great Falls, March 15 to 20, inclusive. The show will be under the direction of the Montana Automobile Distributors' Association.

NO ROOM FOR TRUCKS AT BALTIMORE SHOW

Increased Number of Passenger Car Exhibits Precludes Truck Display

BALTIMORE, Dec. 8—Baltimore's annual automobile show which will be exclusively for passenger cars, will be held in the Fifth Regiment armory, this city, Feb. 3-7 inclusive. It will be under the auspices of the Baltimore Automobile Dealers' Association and will be the first held under their management. Former shows were conducted jointly by the dealers association and the automobile club.

The committee in charge includes F. S. Bliven, president of the Standard Motor Co., Arthur S. Zell, president of the Zell Motors Co., Thomas G. Young, Auto Supply Co., E. R. Myers, president of the Motor Car Co., Walter F. Kneip, president of the Franklin, Motor Co., E. T. Backus, Backus Motor Co., A. H. Bishop, manager of the Autocar Sales and Service Co., W. L. Duck, manager of the Winton Co. John C. O'Brien is general manager of the show.

Ford Runabouts Run Pattern Shop

DETROIT, Dec. 15—Operating the largest jobbing pattern shop in the world with the engines of two Ford runabouts, D. H. Locks cut a niche in the hall of fame for ingenuity, when the coal ban cut off his power. With factory heads throughout the city wracking their brains for a solution to the industrial problem only to give up in despair and close their plants, Locke braced his two Fords and using the rear wheels as pulleys belted his machinery and operated at 100 per cent efficiency.

The Locke Pattern Works occupies two floors of the Siegel building and employs 200 men.

Factory and Town Under Construction

NEW YORK, Dec. 18—C. Harold Wills and John R. Lee, former executives of the Ford Motor Co., have begun construction work on their new plant at Marysville, Mich., where they will manufacture an eight cylinder engine that will sell well under \$2,000. Coincident with the erection of the manufacturing plant they are building, in conjunction with the Pressed Metals Co., Ltd., of Canada, a town site capable of absorbing a population of 100,000.

The unique feature is the fact that this town site is being erected at the same time as the manufacturing plant. Thus proper housing facilities will be provided for employes immediately upon the beginning of production, a practice thus far too uncommon.

PAN MOTOR CO. HEAD GETS 10-YR. SENTENCE

Lawyers File Notice of Appeal —Judge Landis Denounces Delaware Methods

CHICAGO, Dec. 16—Samuel C. Pandolfo, former president of the Pan Motor Co., of St. Cloud, Minn., was sentenced today to serve ten years in prison and pay a fine of \$4,000 by Federal Judge Landis, for use of the mails to defraud. Pandolfo was convicted for organizing and conducting a stock promotion scheme. His attorneys notified the court they would take immediate appeal from the decision.

Other officers and directors of the Pan Motor Co., indicted with Pandolfo were freed except that a charge of perjury still hangs over H. S. Wigle, one of the acquitted men.

In sentencing Pandolfo, Judge Landis arraigned the State of Delaware for its methods of incorporating new companies.

The conviction of Pandolfo closes what has been termed by authorities one of the most remarkable cases in the history of big advertising frauds. Pandolfo and his aids sold approximately \$9,500,000 worth of stock. In his promotion propaganda Pandolfo asserted that eventually his company would be a greater institution than the Ford company.

The national vigilance committee of the Associated Advertising Clubs of the World first called attention of authorities to Pandolfo, by alleging that of each \$2 invested in the concern \$1 went to Pandolfo for his share as fiscal agent and out of which he was to pay promotion expenses. A special appeal to holders of Liberty Bonds, it developed at the trial, had resulted in the subscription of approximately \$1,000,000 being paid for through them.

At a recent reorganization meeting of the Pan Motor Co., it was announced that F. C. Ladner, vice-president, would head an executive committee temporarily to manage the affairs of the company, and that St. Cloud men would succeed three Chicago men as directors. The three St. Cloud men are: J. G. Heidman, J. H. McQuerry and N. A. Street.

"Red Arrow" Truck Makes Appearance

LANSING, MICH., Dec. 15—The "Red Arrow" truck, built by I. L. Story and A. B. Bowmen, made its appearance here recently, experts being favorably impressed with the performance of the new truck. It is a four-wheel drive with several original features at variance with the old models, and is the product of a year's effort on the part of Stoney and Bowmen, who will incorporate under that name. Their

plans call for a factory with 320,000 sq. ft. of floor space in which they will manufacture everything with the exception of engines. They expect to be in production in the early summer. Stoney formerly was connected with the Duplex and Republic, and Bowmen was with the Buick Motor Car Co. Machine work on the "Red Arrow" was started July 8, and the first truck was assembled Oct. 22. It weighs about three tons and its load runs between three and four tons.

Bumper Allowance on Car Insurance

NEW YORK Dec. 15—The use of bumpers on all types of automotive vehicles soon may be considered on a par with fire extinguishers with regard to insurance allowances.

The first step in this direction was taken recently by the Bankers & Shippers Insurance Co., of New York, in the announcement that a special endorsement, covering the use of bumpers on private passenger automobiles, would be attached to collision insurance on request.

The endorsement provides allowances as follows:

Full Collision Coverage—Front bumper 10 per cent of collision premium. Front and rear bumper 15 per cent of collision premium.

\$50 Deductible Collision Coverage—Front bumper 5 per cent of collision premium. Front and rear bumper 10 per cent of collision premium.

\$100 Deductible Collision Coverage—Front bumper 2½ per cent of collision premium. Front and rear bumper 5 per cent of collision premium.

The form is reported to have appealed strongly to car owners, and it is probable that other companies will shortly issue car insurance policies containing the bumper allowances.

Wilmington Show in Week of Feb. 3

WILMINGTON, Del., Dec. 8—It has been definitely decided to hold the 1920 Wilmington Automobile Show at the Hotel duPont the week of Feb. 3. It will be larger than ever before, taking advantage of a new ballroom which the hotel has added since the last show was held. There are about 75 applications for entries.

WORCESTER SHOW SET

WORCESTER, MASS., Dec. 14—The Worcester Automobile Dealers' Association is going to have a motor show during the week of Jan. 19-24 in the State armory. The friction that developed a year ago when one set of dealers got together and started a show has been ironed out, and it is expected that all dealers in Worcester will get behind the exhibition. At that rate there will be a comprehensive show with something like 50 models of cars and trucks exhibited.

Ask Larger Funds

For Research Work

WASHINGTON, Dec. 15—The Bureau of Standards, which was of considerable assistance to industry during the war and carried on research and investigations resulting in valuable information, is requesting \$25,000 for aeronautic instrument investigation, \$20,000 for temperature research, \$150,000 for internal combustion engine research, \$50,000 for lubrication standards, \$50,000 for electrical investigations and \$710,000 for testing machines, industrial research, standardization of mechanical appliances, investigation of optical glass, gage standardization and metallurgical and sound investigations and research, from Congress for the fiscal year ending June 30, 1921.

The Army Air Service, which was granted \$25,000,000 for the fiscal year ending June 30, 1920, has asked for \$60,000,000, \$54,000,000 of which will be used for the establishment of flying schools, purchasing planes, operation of planes, construction, experiments and research, \$6,000,000 of which will be used for construction and enlargement of public buildings.

The Navy, which was granted \$25,000,000 for the fiscal year ending June 30, 1920, is asking for \$35,000,000 for general aviation expenses, including the purchase of five special types of planes, purchase of one dirigible abroad and for helium plants and aircraft stations. The Navy is also asking for \$2,746,000 for the seacoast defense, and \$7,057,000 for aerial defense at Panama. The National Advisory Committee for Aeronautics desires \$320,000 for salaries, publications, etc.

The Bureau of Mines requests \$150,000 for the investigation of petroleum and gases and \$250,000 for the testing of fuels. The Bureau of Public Roads asks for \$748,000.

Service Managers to Hold Convention

NEW YORK, Dec. 8—Factory and local service managers will hold a convention on Jan. 5 at 2 p. m. at the Automobile Club of America. A number of papers will be read on service topics, and discussion and suggestions will be open. The convention will be followed by a banquet. The promotion of the convention is in the hands of the Automotive Service Association of New York.

Raise Admission to

National Shows

NEW YORK, Dec. 8—Admissions to the national passenger car shows in New York and Chicago have been fixed by S. A. Miles, manager for the National Automobile Chamber of Commerce, at seventy-five cents including war tax. Prices of admission to the truck shows in both cities will be fifty cents.

TRAILER ASSN. OPEN N. Y. DISPLAY ROOM

Space on Seventh Floor of Grand Central Palace Rented Permanently

NEW YORK, Dec. 15—The Trailer Manufacturers' Association of America has established a location in the Grand Central Palace, New York, for the display of trailers and the dissemination of information regarding the industry and the use of trailers.

The association has taken office and exhibition space aggregating 5,000 sq. ft., in the International Tractor, Farm Implement and Trailer Exchange section of the exhibition hall. All but three or four of the members of the association having offices or distributing agencies in the metropolis, have taken space in the newly acquired display section.

Latest models manufactured by the following companies will be shown—Detroit Trailer Co., Detroit; Fruehauf Trailer Co., Detroit; King Trailer Co., Ann Arbor; Martin Rocking Fifth Wheel Co., Springfield, Mass.; Northway Trailercar Co., East Rochester, N. Y.; Ohio Motor Vehicle Co., Cleveland, and Rogers Brothers Co., Albion, Pa.

The permanent exhibit will be a great convenience to business houses in the Metropolitan section and to visitors from all parts of the country and foreign countries who desire to investigate trailers and buy them. Here they will find displayed many types, makes and sizes of trailers, and representatives will be prepared to furnish desired information.

Transport Veterans From Legion Post

NEW YORK, Dec. 15—The Motor Transport Post of the American Legion was organized Dec. 8, at a largely attended meeting held at the Motor Transport Club, New York.

The following officers were chosen to serve one year: President, Arthur J. Slade; 1st vice-president, John A. Broderick; 2nd vice-president, L. S. Plaut; 3rd vice-president, Daniel Petruccelly; secretary, Daniel J. Shea, and treasurer, Harvey J. Kutz.

President Slade returned from France a short time ago, where he served with distinction as lieutenant colonel and chief of the engineering branch, office of the director, motor transport corps, A. E. F. He is a member of the A. S. A. E., A. S. M. E. and A. I. E. E.

It is the desire of the post to get in touch with each one of the 1,400 men who enlisted in the original motor transport companies in New York, and then make the headquarters of the post the rallying place for all motor transport men in or near the city. Arrangements are now being made for a general round-up at a large meeting to be

held in January following the automobile show in New York, at which Col. F. E. Pope, assistant to the chief, motor transport corps, will lecture. All former and present members of the motor transport corps are to be invited to attend this meeting.

Maxwell-Chalmers Combine Deferred

NEW YORK, Dec. 16—Deposits of securities in the proposed Maxwell-Chalmers merger have not been large enough to declare the plan operative, according to an announcement made today, and the time for depositing the stock of the companies with the Union Trust Co., for the purpose of exchanging it for stock in the new combine, has been extended to Jan. 31, 1920.

It is proposed to make the exchange on the following basis: 120 per cent of new stock on Maxwell preferred; 66½ per cent on second preferred; 70 per cent on common. 105 per cent of new stock on Chalmers preferred, and 15 per cent on Chalmers common. It also is proposed to exchange par for par, the new stock for the present Chalmers notes.

The committee also announced that it has been unable to secure from bankers, a positive commitment for an extension of time for the purchase by them of \$10,000,000 new notes. It is the intention of the committee, however, to make further attempt to sell the proposed notes in the event that the merger is finally approved.

The name of the new company has not been selected, but it is planned to have the name include the words Maxwell and Chalmers in some suitable combination.

SELL ARMY TRACTORS

WASHINGTON, Dec. 16—The Italian government has sold 2,700 farm tractors to individual farmers and will sell 4,000 more, according to reports received by the Bureau of Foreign and Domestic Commerce.

During the war, on account of the necessity for increasing the country's agricultural production, the Italian government purchased between seven and eight thousand farm tractors in the United States for the operation of which a special section was created in the Ministry of Agriculture. Under the direction of this section squads of soldiers were organized in the principal farming districts to operate the tractors, and in this way a large number of machines were put to work in plowing and cultivating the soil.

With the termination of the war and the consequent demobilization of the army, which during the past few months has been going on at a rapid rate, the pressing necessity for this form of government activity was removed and the necessary personnel for the operation of the tractors became difficult to secure. Consequently the state has decided to withdraw.

American Cars on British Markets

LONDON, Dec. 2—(Special Correspondence)—A recent compilation of the countries of origin of motor cars at present listed on the British market shows that of some 122 makes, 28 are American, 23 French, 7 are Italian; the balance being British, with two makes from Belgium, and the Picard Pictet from Switzerland.

The American makes are the Anderson, Apperson, Briscoe, Buick, Cadillac, Chalmers, Chandler, Chevrolet, Cleveland, Columbia, Dort, Dodge, Hupmobile, King, Liberty, Maibohm, Maxwell, Morris (this is the British name), Oakland, Oldsmobile, Overland, R. M. C., (this is the British name), Roamer, Saxon, Scripps-Booth, Templar and Westcott. The Packard car probably will be listed here again, as the Packard truck is listed.

The American dealers are better placed for delivery than others, and are selling well despite the tariff and adverse difference in the rate of exchange combined, adds about 55 to 60 per cent to their gross price on the British market. Another factor noticeable is the large proportion of six cylinder American makes in this list, the French proportion being nothing like so large.

—Englishman

Two Big Northwest Shows are Combined

MINNEAPOLIS, Dec. 16—The Twin City Automobile, Truck, Tractor and Industrial show, Jan. 31 to Feb. 7, in the Overland building, Midway, is to be combined with the Northwest Tractor Trade Association show, making it stronger than heretofore, and it is to be a national accessories show. The tractor men took the entire first floor of the building and all of the half basement, except that part reserved for the restaurant concession. This will be about 60,000 sq. ft. Each of the other three floors contain 75,000 sq. ft., industries on the second, automobiles on the third, trucks on the fourth and industries. Drawings already have been made for space with larger demand than there is room for exhibits.

PATENT VALVE IN CAR

FT. WAYNE, IND., Dec. 13—Yarrott Bros. Motor & Car Co., recently incorporated here with a capital stock of \$10,000,000, plan the production in the spring of a six and eight cylinder passenger car which will sell at about \$1,000 and \$1,400 respectively. By the use of a patented rotary valve of its own design, the company plans to eliminate valve disturbances.

It is asserted the engine will be very economical, a six cylinder car getting over 24 miles on a gallon of gas. The company has been waiting four years to bring this car out.

FAIRBANKS MORSE TO BUILD HUGE FOUNDRY

Beloit to Be Site of Structure With 505,000 Sq. Ft. of Floor Space

BELOIT, WIS., Dec. 13—Fairbanks, Morse & Co., announce the erection in Beloit next year of the most modern type of foundry in the world. When completed it will be 900 ft. long, 550 ft. wide, and will contain 495,000 sq. ft. of floor space. The structure will cover eleven acres and will include space for storage of sand, flasks, iron and other materials. An ultimate production of 350 to 400 tons of gray iron daily will be reached.

Fifteen hundred additional men will be employed in the huge foundry and another 1,500 will be required in other branches of the factory to meet the increased production that will result. Raw materials for the construction of the factory will be placed on the ground this winter and actual building will start as soon as weather conditions in the spring permit.

Every modern scientific foundry device and every improvement in the casting of gray iron, will be incorporated in the Beloit plant. Electric cranes will carry raw materials to and from the big cupolas. Electric grab buckets will unload the moulding and core sand and coke. Electric magnets will grip the raw pig iron and remove it from the cars. Electric cranes and conveyors will carry the molten metal from the cupolas to every mould, whether for giant castings of 10,000 pounds or for tiny ones of a few ounces.

Ideal working conditions will be afforded employees. The plant will contain a complete ventilation system that will change the air in the vast structure frequently, independent lockers for all workers, a complete system of hot and cold shower baths for the entire force, and a modern cafeteria.

Reo Assets Gain

\$1,000,000 in 1919

DETROIT, Dec. 13—Substantial gains in assets, surplus and working capital are shown in the annual statement of the Reo Motor Car Co., for the fiscal year ending Aug. 31. The fact that the first five months of the fiscal year were spent in war work, and after-war readjustment emphasizes the creditable showing.

Total assets are \$16,449,785.29, an increase of approximately \$1,000,000 over 1918. Surplus of \$6,390,333.94, almost equal to the \$6,937,250 of outstanding stock compares with \$5,494,828.18 in 1918. Current assets aggregate \$11,184,130.24 as against \$10,460,231.69 a year ago and current liabilities are \$3,122,201.35, compared with \$3,358,304.21.

The net working capital Sept. 1 was \$8,061,928.89, approximately \$1,000,000 greater than the previous year. The current assets comprise cash on hand and in banks \$1,063,377.74, bills receivable \$957,139.05, due on government contracts \$603,952.80, Liberty bonds \$270,705.88, and inventories \$8,288,954.77.

Current liabilities include notes payable \$1,000,000, accounts payable \$1,400,619.40, accrued payroll, \$159,028.23, reserves for federal and local taxes \$514,948.72 and dealers' contracts \$47,605, a total of \$3,122,201.35.

Fixed assets aggregate \$5,161,475.17, compared with \$5,229,537.80 in 1918. The statement showing \$529,902.67, charged off for depreciation on buildings and machinery. Investments total \$80,787.50 of which \$78,787.50 represents the company's interest in branches and \$2,000 in stocks and bonds. No change in authorized or outstanding capital stock was made during the year. Of the \$10,000,000 authorized capital \$6,937,250 is outstanding.

Ohio Assn. Holds Biggest Convention

CLEVELAND, Dec. 6—The Ohio Automobile Trade Association ended yesterday the most successful convention it ever held. Eight hundred people attended a banquet in Gray's Armory, Thursday evening, which is said to have been the largest group of dealers ever assembled at an affair of that kind.

Crow-Elkhart Co. Is Reorganized

SOUTH BEND, IND., Dec. 15—Dr. E. C. Crow and Martin E. Crow of Elkhart, Ind., have disposed of their interests in the Crow-Elkhart Motor Co., of Elkhart to a combination of New York and Ohio capitalists and a complete reorganization of the company has been effected. J. A. Harps of Greenfield, O., has been elected president. R. B. Donaldson, of Lockport, N. Y., formerly of the Covert Gear Co., and chairman of the creditors committee during the financial difficulties of the Crow company a year ago, has been elected vice-president and general manager. C. B. Lair, of Greenfield, O., a capitalist, has been elevated a director. It is said ample capital will be added to assure the future of the company.

SHIP COLUMBIAS SOUTH

DETROIT, Dec. 13—Columbia Motors Co., this week shipped a solid trainload of 45 cars of Columbia Sixes to the Cole Motor Co., Jacksonville, Fla., for distribution in that state. Several other trainload shipments have gone out from the factory recently and the trainload order has ceased to be a novelty. The highly prosperous condition of the south strikingly is illustrated in the demand for cars and trucks.

Texas Votes Huge Fund for Highways

AUSTIN, TEXAS, Dec. 15—No previous year will compare with 1919 in money expended in Texas for construction of highways. It is shown by records of the State Highway Department that for the eleven months to Dec. 1, a total of \$80,457,000 in bonds had been voted by counties of Texas, the proceeds used and to be used in the construction of good roads.

In addition to this sum already voted, bond issues for the same purpose amounting to \$38,568,000 are pending and under consideration. Added to the total amount of bonds voted by counties is a fund obtained from automobile and other motor vehicle licenses amounting up to Dec. 1 to \$1,381,308.16, and a Federal good roads fund of \$10,175,806.31 for the years 1919-1920. The total number of automobiles registered for the eleven months was 323,235, an increase of 72,177 over the preceding year.

Construction of highways in Texas during the last several months has been greatly retarded by long periods of unprecedented rains and a general shortage of labor. Many counties, however, have purchased good roads equipment, in the way of tractor engines and graders and are prepared to carry on an extensive program of improvement during the next several months.

The proposition of amending the constitution so as to authorize the issuing of \$75,000,000 in bonds, the proceeds to be used in building good roads was defeated at the recent election, but this has not deterred the different counties from voting bonds for the purpose.

LEXINGTON PRICE GOES UP

CONNERSVILLE, IND., Dec. 17—Prices on the Lexington Minute Man Six are announced by the Lexington Motor Co., as follows:

Touring	\$1,885
Thorobred	1,885
Lex-Sedan	2,285
Sedanette	2,850
Coupe	2,850

TO MAKE SPECIALTIES

ST. PAUL, Dec. 16—The Witte Auto Radiator Co. has filed articles of incorporation at \$130,000 and will make automobile radiators, parts and specialties. The incorporators are Meinhard Witte, of Minneapolis, John Taith, of Spicer, Minn., and O. A. Orred, of Superior, Wis. The company has leased space in the factory building at Hampden and Hersey streets.

INCREASE CAPITALIZATION

HARTFORD, WIS., Dec. 15—The International Steel Products Co., of Hartford, Wis., manufacturer of mufflers or silencers for internal combustion engines, has arranged for additional working capital and will enlarge its output.

NAPIER CHASSIS NOW PRICED AT \$10,500

Increase From \$8,750 Announced to Dealers as Required by Extra Costs

LONDON, Dec. 2, 1919—(Special Correspondence)—The following letter has been issued to the British motor press by the Napier company. It is dated Nov. 25th.

"When we announced to you at the end of September last that the selling price of this chassis would be \$8,750 we had every hope of being able to supply at that figure, but we find that having regard to the increased cost of material, labor and other charges, that we must in common with other British motor manufacturers increase our selling price for the chassis, and after careful consideration have decided to raise this to \$10,500."

"Apart from the fact that the increased cost of steel is three times that of pre-war period; aluminium two and a half times; labor and over-head charges more than double, and production less per man owing to the reduction of working hours, there is the fact that since we announced the price in September last, there has been a further award of \$1.20 per week in the engineering industry, affecting not only our labor costs, but material suppliers as well.

"In addition to this the moulders' strike has been in force for nearly ten weeks which naturally has the effect of upsetting all calculations as to production and increasing costs accordingly. You will, therefore, be able to form some idea as to why it is necessary to make the selling price per chassis in proportion to these rising costs of production.

"We have not, of course, the same advantage in producing a new model as those who are simply keeping to their old types with a few alterations, so that we have more justification than others in raising our selling price—but we are supplying a chassis thoroughly up-to-date in design and the very best that can be produced, necessitating the use of the highest class of material and workmanship."

The weight of the Napier chassis is roughly 3,000 lbs., so that at the new rate it will cost the buyer at home \$3.33 per pound, which is about a record charge for any piece of machinery for common use. Englishman.

Oakland Show Dates

January 19 to 25

OAKLAND, CAL., Dec 15—The motor car dealers' division of the Alameda County Automobile Trade Association will hold its automobile show in Oakland Jan. 19 to 25 inclusive, in the Civ-

ic Auditorium, under the management of Robert W. Martland. The show committee consists of J. Charles Nagel, Howard Rector, Harold Knudsen, Charles Helbrank, E. Wells and William Webber.

There will be 21,000 sq. ft. of show space available, drawings for which will be held at a date soon to be announced. Passenger cars only will be shown in the arena of the auditorium, trucks and commercial vehicles and equipment being consigned to the corridors.

Architects Add Automotive Department

NEW YORK, Dec. 12—Mann & MacNeill, architects and construction engineers, have added to their organization an automotive department with headquarters in the Book Building, Detroit. This department is designed to render expert building service to automobile dealers, garagemen, repairmen and others engaged in retailing automotive merchandise.

The aim of the new department is given as to cut the cost of construction and to increase the operating efficiency and salespulling power of automotive buildings by improved design. Its advent is announced due to the fact that a salesroom, garage or service station is a specialized form of construction similar to an hotel or theatre and that detailed knowledge of the automobile business is primarily necessary.

Harold F. Blanchard has been appointed chief engineer of the new department. He has made a special study of the efficient layout, design and erection of automobile buildings and is conversant with details of the automobile business, so that he can approach a building problem from the dealer's standpoint.

Garages without columns for supporting floor or roof trusses will be specially featured. Another feature will be the application of effective design to garage fronts.

ERECT TRACTOR BUILDING

FARGO, N. D., Dec. 16—The local branch of the Minneapolis Steel & Machinery Co. is erecting a building, three stories, fronting 100 ft. on N. P. avenue, where the All-Steel and Twin City kerosene tractors will be carried with parts and supplies. The first tenant will be the Gate City Auto Show, the annual event of the Fargo and Moorhead Dealers' Association. The dates are Feb. 10-13, 1920.

LOCATE DETROIT BRANCH

DETROIT, Dec. 12—The J. N. LaPointe Co., of New London, Conn., manufacturers of breaching machines and breaches, has established a branch in Detroit in charge of W. H. Nicholls, of New London. The company has secured an attractive location at 11 Harper Avenue East.

Motor Exports Hit

by British Bill

LONDON, Nov. 21—(Special Correspondence)—An Imports and Exports Regulation Bill, issued today, is to prevent goods being imported to Great Britain manufactured under conditions so inferior to those in British workshops as either to permit of their being sold to the prejudice of home-made corresponding articles, or purposely dumped here irrespectively of the cost of manufacture and transport.

Certain goods are to be specially protected as the products of "key" industries. The motor industry is concerned directly only in magnetos and indirectly in scientific and optical instruments, gauges, optical glass, lenses, tungsten and ferro-tungsten, all of which are scheduled as "key" industries, and are not to be imported except under special license.

Motor vehicles and motor parts of any sort are not named, but the bill is so comprehensive as to the powers sought to be vested in the government executive, that its terms require careful discussion. For instance, power is sought to safeguard industries affected or likely to be affected by the depreciation of foreign currency, a step which would make it possible just now to exclude all European goods.

Good Roads Meeting at Hot Springs April 12

BIRMINGHAM, ALA., Dec. 15—The Eighth Annual Convention of the United States Good Roads Association will meet at Hot Springs, Ark., April 12-17. One of the attractive features of the meetings will be the exhibition of machinery, road and street material, trucks, tractors and automobiles.

The U. S. Government is planning to show road models and the War Department also will have an exhibit.

OBTAI BRITISH CONTRACT

DETROIT, Dec. 15—The American Commercial Car Co., has secured a contract for the delivery of 600 trucks in 1920 to the H. C. Motor Co., London, Eng. The rapidly expanding business of the company necessitates many additions and improvements in plant and equipment, according to President H. C. Weideman, who said the expansion program would be announced at the end of the company's fiscal year, Dec. 31.

LEBANON SHOW SET

LEBANON, PA., Dec. 15—The annual automobile show of the Automotive Trade Association of Lebanon will be held March 10 to 13, in the James Furniture Store building under the auspices of the association. J. Paul Enck will be in charge of the exhibit which will set a new mark for automobile shows in this city.

Automotive Exports Larger for Month of October

1919	Cars	Value	Trucks	Value	Parts
October	7,898	\$8,634,965	1,301	\$2,931,204	\$3,525,029
September	6,283	6,838,439	1,359	3,369,581	4,560,273
1918					
October	1,709	1,882,092	737	2,192,556	3,700,687

WASHINGTON, Dec. 12—October exports of automotive equipment, the figures for which have just been made public here, were featured by the heavy increase over the September totals in the shipments of passenger cars to foreign countries. The month saw the total reach the unusually heavy figure of \$8,634,965, an advance of some 1½ millions over the preceding thirty-day period.

The increase in this respect, however, was not held up in the exportation of trucks and parts. Both of these showed an appreciable loss from the September peak, although the gain in the passenger car shipments more than offset this loss.

Nearly every country for which the figures were published, aided in increasing the car exports, the Argentine and Mexico being among the few in which takings were less. England, her market swinging open for American machines after the lifting of the export ban, imported the surprising number of 1,351 cars, as against 980 for September, the advance in value over the other month being something in excess of \$500,000. Other British dominions—such as Canada, British South Africa and British India, also drew more heavily upon the makers of this country.

The United Kingdom also became a larger truck market, importing 117 as against 9 during September. Both France and Canada imported a smaller number of the commercial vehicles.

The accompanying tables give details of the shipments, which do not include those of tires.

Exports of Automotive Equipment for October and Ten Months Ending October, 1919.

	1918		1919		1918		1919	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	1	\$ 800	3	23,000	29	\$ 418,255	35	\$ 153,200
Airplane Parts	790	262	...	30,871	...	11,162,210	...	3,171,283
Commercial Cars	737	2,192,556	1,301	2,931,204	8,438	21,468,901	12,367	29,687,118
Motorcycles	620	157,112	3,283	924,235	8,074	1,880,580	19,279	5,265,516
Passenger Cars	1,709	1,882,092	7,898	\$8,634,965	33,007	31,498,643	52,189	57,458,726
Parts, not including engines and tires	3,700	687	...	3,525,079	...	29,248,820	...	33,919,092
ENGINES								
Automobile, Gas	3,297	\$ 417,177	2,889	\$ 388,730	26,321	\$ 3,499,161	25,933	\$ 3,958,532
Marine, Gas	310	296,021	815	259,840	4,359	2,298,390	9,516	3,977,011
Stationary, Gas	2,893	368,180	1,408	245,213	24,662	2,857,450	21,179	3,107,035
Tractor, Gas	1,213	1,586,088	1,749	1,528,745	20,940	22,184,140	17,976	17,747,643
Total	7,713	\$2,667,466	6,561	\$2,422,528	76,282	\$30,839,141	74,604	\$23,790,221

Exports by Countries for October and Ten Months Ending October, 1919.

	Cars		Trucks		Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Denmark	329	\$ 311,982	...	...	2,297	\$ 2,603,973	...	...
France	116	185,400	256	1,049,439	628	1,724,384	3,192	13,923,164
Norway	204	432,943	...	...	1,536	1,965,038	...	...
Russia in Europe	200	302,988	...	...	1	2,000	2	1,180
United Kingdom	1,351	1,445,136	117	174,756	3,800	3,906,023	197	327,841
Canada	1,004	1,053,433	153	248,955	7,603	7,822,416	1,595	2,455,828
Mexico	252	219,061	...	...	2,251	1,812,628	...	...
Cuba	321	297,204	66	132,074	2,016	2,265,550	672	1,454,316
Argentine	104	171,463	2	3,280	1,620	2,003,400	138	206,713
Chile	26	30,943	1,312	1,340,170	442	670,236	...	...
Uruguay	66	103,450	...	...	1,848	2,040,685	...	...
British India	427	455,091	...	...	1,623	2,096,858	...	...
Dutch East Indies	98	111,981	...	...	49	52,145	0	15,840
Russia in Asia	...	...	4	10,790	2,022	3,031,652	...	...
Australia	390	432,139	...	...	2,237	2,497,021	...	...
New Zealand	298	349,437	...	...	2,064	2,228,435	...	...
Philippines Is.	86	88,290	...	...	2,181	2,544,147	...	...
Br. So. Africa	363	414,850	...	...	14,076	1,534,227	6,563	11,241,418
Other Countries	2,164	2,229,156	702	1,309,910	...	...	...	...
Total	7,898	\$8,634,965	1,301	\$2,931,204	52,189	\$37,458,726	12,367	\$29,687,118

Army Generators and

Engines on Sale

WASHINGTON, Dec. 17—The director of sales announces that the surplus property division of the Quartermaster General of the Army, is offering for sale 400 gasoline driven, electric generator sets, with switchboards and gasoline tanks. Offers will be received by the Surplus Property Division, Munitions Building, Washington.

The generator is a 25 kilowatt, direct current commutating type. Either 115 volt, two wire, or 230 volt, three wire generators can be supplied. The engine is of the closed, four cycle, single acting, vertical type, with four cylinders and is capable of operating the generator at full load indefinitely and at a 25 per cent overload for two hours. The machines were designed for close regulation which makes them desirable for small electric light and power plants.

The division is also offering at fixed price, 121 fifty h. p., and 192 35 h. p. gasoline engines with clutches. These engines are of the four cycle, four cylinder type, and are equipped with starting motors and lighting generators, poppet valves, zenith carburetors, Philbin Duplex ignition, centrifugal water pumps and Hele Shaw clutches. The 50 h. p. are priced \$700 each, and the 35 h. p., \$640. A 15 per cent reduction on these prices will be given to purchasers of ten or more.

NEW CARBURETOR USED

DETROIT, Dec. 15—Ford Motor Co., now is installing the Holley carburetor on its cars as rapidly as the Holley Carburetor Co. is able to furnish them. The new model NH is an improvement over the model G in respect to fuel economy, flexibility and engine power, and the company has arranged to supply a limited number to Ford dealers in combination with the Holley manifold. The new equipment is said to overcome engine troubles due to the present low grade of gasoline, the manifold utilizing exhaust heat for vaporizing the fuel.

TO MAKE CONVERTED TRUCK

MINNEAPOLIS, Dec. 16—The Gas Motor Truck Co. has been incorporated with \$250,000 authorized capital to manufacture the Lenhart Truckmaker, to convert passenger cars into motor trucks at a cost of \$600, with any type of body desired. The company, which has a factory at 2600 University avenue SE., has been making wagons for many years. F. F. Lenhart is president of the company and R. F. Lenhart, manager.

CUMBERLAND FIXES SHOW

CUMBERLAND, MD., Dec. 15—Automobile dealers in this city will hold a motor car show in the Armory on March 31 and April 1. The show is being held by the Automobile Dealers' Association, J. H. G. Miller, manager.

Chandler Motor Car Co. has declared an initial dividend of \$2 a share on the new stock, payable Jan. 2 to stockholders of record Dec. 15.

International Motor Truck Corp. has been authorized by stockholders to increase the authorized common capitalization from 53,638 to 80,480 shares of no par. The authorized second preferred stock has been increased from 27,230 shares (par 100) to 53,478 shares, and the authorized first preferred issue has been increased from 43,816 shares (par \$100) to 109,219 shares.

Dail Steel Products Co., of Lansing, will increase its capitalization from \$100,000 to \$250,000 to permit expansion to keep pace with increasing business. The new issue has been approved and most of it will be taken up by stockholders. Work on new buildings will start soon after Jan. 1.

Savold Tire Corp., through President Downey, announced in a statement to stockholders that the earnings of the corporation in 1920 would approximate \$1,000,000, equal to 20 per cent on the stock.

Edmonds & Jones Corp., automobile lamp manufacturers, will utilize an accumulated surplus of \$1,100,000 in erecting new plant additions, authorized at a special meeting of the directors. Surplus profits for ten months up to Oct. 31 were \$438,000.

Auto Wheel Co., has notified stockholders of the authorization of a cash dividend of 6 per cent, payable Dec. 20. The dividend was authorized at a directors' meeting Oct. 30.

Dunlop Rubber Co. is issuing 1,000,000 one-pound shares at 8 pounds each. It is stated the company intends to undertake energetic American expansion and also a world-wide development.

Goodyear Tire & Rubber Co., of Canada, Ltd., plans to increase its capital from \$3,000,000 to \$30,000,000 if the approval of stockholders is granted at the annual meeting Dec. 13. The shares will be divided into \$15,000,000 common and \$15,000,000 of 7 per cent cumulative preferred stock. Of the new preferred \$5,000,000 will be issued at once, \$3,000,000 to be placed in Canada and \$2,000,000 in the United States. Present outstanding \$1,500,000 preferred stock will be redeemed Jan. 1, 1920, at 110.

Bethlehem Motors Corp. has been authorized by its stockholders to increase the capitalization from 130,000 shares to 200,000 shares, no par value. Of the new stock 43,000 shares will be offered to stockholders of record Dec. 12, for subscription at \$28 a share.

Financial News

Electric Storage Battery Co. has declared a 2½ per cent quarterly dividend on its common and preferred stock, payable Jan. 2 to stockholders of record Dec. 15. Previously the company paid 2 per cent on the common and preferred.

Chandler Motor Car Co. reports net earnings for October before payment of taxes, of \$909,516, which is at an annual rate of \$52 a share on the 210,000 shares outstanding.

Welever Piston Ring Co., Toledo, increased its capital stock from \$20,000 to \$100,000 and is installing new machinery to care for a fourfold increase in business.

Napoleon Motors Co., of Traverse City, Mich., has been given permission to issue another block of \$250,000 worth of stock and preparations are being made for doubling the output of Napoleon trucks. New buildings for the export department rapidly are being completed.

Jordan Motor Car Co., Inc., Cleveland, has authorized the payment of 1¾ per cent dividends on the preferred stock of the company, and \$2 a share on the common stock on Dec. 31 to stockholders of record Dec. 13.

Republic Motor Truck Co., Inc., reports for the year ended June 30, 1919, a surplus after charges, taxes and preferred dividends of \$495,603, equal to \$4.95 on the 100,000 shares of common stock of no par, compared with \$6.79 a share in the preceding year.

The Highway Trailer Co., Edgerton, Wis., has authorized an issue of \$320,000 of 7 per cent cumulative preferred stock, of which \$100,000 is now being marketed. A dividend of 10 per cent was declared and offered paid.

Duplex Truck Co. reports as of Oct. 31, current assets of \$724,864.72, and a plant investment of \$682,369.17, a total of \$1,407,233.89. Current liabilities of \$67,750.16 are listed and \$56,394.97 is reserved for taxes. A dividend of \$100,000 was paid Nov. 15, representing 10 per cent of the outstanding common stock.

Mullins Body Corp. shareholders have taken the entire additional issue of 30,000 shares of common stock offered for subscription at \$44 a share. Capitalization now consists of \$1,000,000 eight per cent preferred and 100,000 shares of common stock of no par value. Net earnings in 1920 are estimated at \$13 a share on the common stock.

Firestone Tire & Rubber Co. did a business of \$91,078,513 in the year ended Oct. 31, 1919, as against \$75,801,506 last year, according to President H. S. Firestone's report to stockholders. This is an increase of 20 per cent. Net profits after allowing for depreciation and bad accounts, amounted to \$9,308,978, of which \$2,597,000 has been paid out in dividends and the balance carried to surplus, subject to corporation income and excess profits tax accrued.

Saxon Motor Car Corp. stockholders have taken 32,500 of the 120,000 shares of no par value stock offered at \$13.50 a share, under the reorganization, on the basis of two shares for each share held. The right to subscribe has expired.

Stromberg Carburetor Co. of America, Inc., for the three months ended Sept. 30, 1919, reports a surplus after taxes and charges of \$102,342, equal to \$2.04 a share on the 50,000 shares of no par.

Mexico Doubles Use of Motor Trucks

MONTEREY, MEXICO. Dec. 15—Within three years the sale of automobiles and motor trucks in Mexico has doubled. The mining companies are using trucks in large numbers and with a view to establishing regular motor transportation systems a truck train is being run into Mexico. Nearly all of the automobiles and motor trucks being sold in the northern part of the country are American make, there being a few French, Italian and German models.

The States of Coahuila and Nueva Leon are not as far advanced in the use of motor truck transportation as the section around Mexico City, Torreon and Tampico, it is stated. The damaged highways of Coahuila and Nueva Leon are much to blame for this. With the repair of roads, it is believed trucks will come into general use in these two states. The government is preparing now to improve the roads in Coahuila.

Much significance is attached to the proposed establishment of a regular motor truck route between Monterey and San Antonio, Texas, a distance of 300 miles. It is stated by Richard F. Bibb, of Saltillo, Mexico, owner of the new truck line, that it will be in operation early in 1920.

S. C. Johnson Dies After Long Career

RACINE, WIS., Dec. 15—Samuel Curtiss Johnson, founder of S. C. Johnson & Sons, Racine, Wis., manufacturers of automotive specialties, died Dec. 7 at the age of 86 years. He was born in Elyria, O., and went to Racine in 1880 after spending 20 years at Kenosha, Wis. From an insignificant beginning in 1905, the present large factory, covering a square block, was developed by him. The company is particularly well known as a maker of waxes, polishes, anti-freeze solutions and other specialties. Mr. Johnson is credited with being the first Racine employer to introduce the bonus system of rewarding employes for faithful service.

NAMED SALESMANAGER

ROCKFORD, ILL., Dec. 15—D. W. Bay, formerly sales engineer of the motor bearings division of the Hyatt Roller Bearing Co., has been appointed salesmanager of the Cotta Transmission Co., Rockford. F. W. Ramey who recently returned from overseas will be assistant salesmanager.

E. A. Bates has severed his connection with Benecke & Kropf to become president and general manager of Booty Carburetor & Mfg. Co.

E. V. Swanstrom, connected for some years with the Moto Meter Co., Inc., manufacturers of the Boyce moto meter, has resigned to become affiliated with the sales force of the Boyce-Veeder Corp., of Long Island City, N. Y., manufacturers of the Boyce Automatic Hand Operating Fire Extinguishers.

Flavius G. W. Sudrow, zone salesmanager of the Chevrolet Motor Co., of Kansas City, and treasurer of the St. Louis Body Co., St. Louis, has resigned to become distributor of Gardner automobiles in Kansas City and the southwest.

A. G. Underwood, from the Milwaukee and Pacific coast branches of the B. F. Goodrich Rubber Co., has been made manager for the Minneapolis branch, and will introduce the Diamond tire. A. Koehler, who has been manager for eighteen months, has gone to the Akron office.

J. E. Orr has been made manager of a direct factory branch established by the Canton-Blackstone Tire Co., Marquette avenue and Eighth street.

Austen F. Beam has been promoted to secretary-treasurer of the Simon Sales Co. R. L. Newton, wholesale salesmanager, is elevated to the position of manager of the truck department, and he is succeeded in the wholesale department by Russell E. Paige, assistant retail salesmanager. Fred Willmott, of the sales staff, succeeds Paige.

A. L. Pschaiden, Detroit motor truck engineer, has become assistant engineer of the Reynolds Motor Truck Co., Mt. Clemens, Mich.

Men Of the Industry Changes in Personnel and Position

NEW GOODRICH MANAGER

DETROIT, Dec. 15—Robert C. Hargreaves, "father" of and secretary to the Highway Transport Committee of the Council of National Defense during the war, has been made manager of the Detroit branch of the B. F. Goodrich Rubber Co. Hargreaves succeeds P. P. Opper, who resigned recently. Realizing the needs of full utilization of the national highways as an auxiliary to the railroads early in the war Hargreaves called together heads of Detroit truck concerns, highway engineers and war department officials. The transport committee was the result.

L. M. Lloyd, former advertising manager, has been made president of the Edward A. Cassidy Co., succeeding E. A. Cassidy, who died recently.

Ralph N. Soule has been made manager of the service department of the Dort Motor Car Co., Flint, Mich.

Earl E. Dawson, manager of the Chevrolet retail store in Detroit, has been promoted to salesmanager of the Chevrolet Motor Car Co., at Flint, Mich. He succeeds C. C. Meade, who goes to Kansas City.

Charles Hendy, Jr., manager of the Ford agency in Denver, has been promoted to the management of the Chicago division. Edward Afton has been named to succeed Hendy at the Denver office.

J. L. Goodall has been promoted to New York branch manager for the Bearings Service Co., of Detroit, to take the place of L. H. Ward, resigned. Goodall was formerly manager of the Indianapolis branch. Succeeding him there will be R. N. Gauss, previously assistant branch manager. H. N. Brandon, branch manager at Omaha, has been appointed branch manager at Milwaukee.

Harry Phelps has been appointed purchasing agent of the Atterbury Motor Car Co. He was fourteen months in France with the 302nd engineers. Formerly Phelps was with the Curtiss Aeroplane Co., and the American Radiator Co.

R. Charles Brower, service manager of the Harrison Radiator Corp., Detroit, has resigned that position to join the Clark Trucktractor Co., of Chicago. Previously Brower was travelling service manager of the Hyatt Roller Bearing Co., and eastern district manager of the Bearings Service Co.

"Wild" Bill Endicott, former racing driver, is now superintendent of the service department of the New England Velie Co., Boston, which handles the Velie and Briscoe lines.

NAME JACKSON OFFICERS

JACKSON, Mich., Dec. 6—Jackson Motors Corp. announces the selection of E. M. Benedict as works manager and Guy C. Core as advertising manager. The company plans a production of 3,000 of the Jackson Six by July, 1920, together with several hundred 3½ ton four-wheel drive Jackson trucks. Benedict, who will be in charge of the production program, formerly was with the Hayes Wheel Co. Core, a former Chicago newspaper man, was formerly with the Briscoe Motor Corp., and the Springfield Body Co.

DWIGHT MAKES CHANGE

RACINE, WIS., Dec. 15—John H. Dwight, vice-president and general manager of the Belle City Malleable Iron Co. and Racine Steel Castings Co., Racine, Wis., has resigned, effective Jan. 1, to accept the position of assistant general manager of the Saginaw Products Co., Saginaw, Mich., division of General Motors Corp.

Harry L. Archey, formerly president of the Indianapolis Automobile Trade Association, has been appointed salesmanager of the Bacon Motors Corp., of Newcastle, Pa.

W. E. Lewis has been appointed manager of the McGee Sales Co., a company formed to market the Stearns car in Indiana.

Edw. F. Sullivan, designer and chief engineer of the Homer Laughlin Engineers Corp., has been appointed chief engineer of the Stockton Tractor Co., of Stockton, Cal. He will produce a creeper attachment for the Stockton wheel tractor, and a special built creeper tractor to be used in the cultivation of sugar cane. The Homer Laughlin Engineers Corp. has discontinued its factory at Los Angeles and will have the Laughlin tractor built by a corporation in the east.

Dan C. Swander, vice-president and director of the sales of the Standard Parts Co., Cleveland, takes on additional responsibilities as assistant general manager, announcement of which appointment has just been made.

MENOMINEE REORGANIZED

MENOMINEE, MICH., Dec. 15—The reorganization of the Menominee Motor Truck Co., of Menominee, Mich., has been effected following the acquirement of the major interest by men closely identified with the Four Wheel Drive Auto Co. of Clintonville, Wis. The new officers and directors are: President, Antone Kuckuk, Shawano, Wis.; vice-president, W. A. Hold, Oconto, Wis.; secretary and treasurer, J. A. Bell, Clintonville, Wis.; directors, Charles Hagan, Appleton, Wis., and D. J. Rohrer, Clintonville. Bell has been in charge as general manager since the ownership changed early in November, and will continue in this position. He formerly was assistant general manager of the F W D works at Clintonville. New capital will make it possible to provide a quantity output of the present Menominee truck, which design will be continued without material change.

**Seaman Body Corp.
to Build New Plant**

MILWAUKEE, Dec. 15—A mammoth motor car body building plant representing a total investment of nearly \$2,000,000 when completed, will be established in Milwaukee by the Seaman Body Corp., as the development of the present large body business of the W. S. Seaman Co.

Contracts were awarded during the week for the first unit of a new factory at Port Washington road and Lake street, which will be 420 ft. long and 720 ft. wide, four stories high. The first unit will be 180 x 420 ft., and next year will be enlarged to embrace three additional units of the same size. There is room for a total of six units. Each will employ 1,000 workmen.

The present Seaman factories, employing a total of nearly 1,400 men, will be continued in operation until the six units on the new site are finished. The present main office and factory is located at 480 Virginia street, and factory Nos. 2 and 3 at 233-253 Clinton street.

The Seaman Corp. specializes in fine closed bodies, but also makes touring and roadster bodies. It has large contracts with the Nash Motors Co., Kenosha, Wis.; the Moline-Knight Automobile Co., Moline, Ill., and other large passenger car builders. It also makes all side-cars for the Harley-Davidson motorcycle.

AMERICAN TIRE TO BUILD

AKRON, O., Dec. 13—The American Tire & Rubber Co. will soon start the erection of a four-story factory building to increase its facilities. The structure will be of fire proof construction with extra window space.

TOLEDO CO. TO MOVE

TOLEDO, O., Dec. 13—The Toledo Steel Products Co., until recently the Lewis Steel Products Co., will move from its present location to its new factory on Summit street and the Maumee River on or about Jan. 1.

COMBINE TOOL COMPANIES

PHILADELPHIA, Dec. 13—The business of the Carlson-Wenstrom Co., and the Carwen Steel Tool Co., Philadelphia, will be continued by A. H. and F. H. Lippincott, manufacturers of screw machine products who have purchased the assets of these two companies and under their supervision will manufacture the Carwen Dynamic Balancing Machine and all classes of special machinery in conjunction with their screw machine products.

Joseph A. Gangster will be associated with the corporation as director and works manager, and Jacob Lundgren, as engineer. The business will be conducted under the corporate name of Lippincott-Carwen Corporation. Officers are A. H. Lippincott, president; F. H. Lippincott, vice-president; A. A. Cavanaugh, secretary.

**Current News Of
Factories**

**Notes of New Plants—Old
Ones Enlarged**

CANDLER CO. TO BUILD

DETROIT, Dec. 15—The Candler Radiator Co., has purchased a site for a new factory building at Shoemaker road and the Detroit Terminal R. R. and construction of the new building will be started soon after the new year. The site fronts 150 ft. on Shoemaker road and runs back 1,230 ft., totalling 4½ acres. Plans for the building have been completed and the company expects to announce further expansion plans when work on the factory is started.

CADILLAC BREAKS GROUND

MILWAUKEE, Dec. 15—Ground is being broken for the new branch assembling and distributing plant of the Cadillac Motor Co. in Milwaukee, Wis. The first unit will be 150x204 ft., three stories and basement, and with equipment is estimated to cost \$250,000. It is located at North avenue and Bartlett street, on the main line of the Chicago & Northwestern road. It is planned to start operations by March 1.

INCREASE CAPITALIZATION

MINNEAPOLIS, Dec. 16—The Gas Traction Foundry Co., has changed its name to Northwestern Steel and Iron Corp., with an increase of capital from \$100,000 to \$200,000. D. A. Potter is president and C. L. Rotzel is secretary.

ONEIDA ADDS FACTORY

GREEN BAY, WIS., Dec. 15—The Oneida Motor Truck Co., Green Bay, Wis., is laying foundations for a brick and steel factory addition, 60 x 250 ft., which will increase the floor space to 200,000 sq. ft., and make possible an output of about 2500 trucks and 200 to 300 Oneida electric tractor-trucks for 1920.

NEW RIE NIE FACTORY

MINNEAPOLIS, Dec. 15—Durkee-Atwood Co., manufacturers of the Rie Nie products, has moved into its new building here, and plans to double its output of Rie Nie products. A new fabric fan belt, designed for the company, which is claimed to be impervious to oil, water, and unaffected by heat, will be manufactured in the new plant and soon placed on the market.

WILL ENLARGE FACTORY

APPLETON, Wis., Dec. 8—The Langstadt-Meyer Co., Appleton, has plans for large additions to its factory which will cost about \$75,000 and be devoted exclusively to the manufacture of two types of self-contained generating units which it has been making for several years. The

MACKEY PRODUCTION SOON

NEW YORK, Dec. 15—Production is scheduled to start early in January in the recently completed plant of the Mackey Truck & Tractor Co., Ravenna, O. The company is to manufacture a four-drive tractor.

NASH PLANT SOON READY

MILWAUKEE, Dec. 15—The new Milwaukee plant of the Nash Motors Co., Kenosha, Wis., which will be operated as the Nash Four-Cylinder Car Division, is rapidly nearing completion and will be ready to commence production Jan. 1. The first unit of the main shop, 200x600 ft., is now receiving machine tools and other equipment, having been erected in 75 days. The power house, 75x150 ft., is enclosed and the boilers are installed. As soon as weather conditions permit next spring, a second machine shop unit, 200x600 ft., and an office building will be erected. The plant is located at Clement and Oklahoma avenues, at the southern city limits of Milwaukee, and will produce the new Nash Four exclusively. The main works at Kenosha will continue to make the Nash Six, Nash Quad, Nash trucks, and possibly a tractor. P. W. Twyman, formerly head of the Inter-State at Muncie, Ind., is general manager of the Milwaukee division.

TO OPEN HOLLY PLANT

HOLLY, MICH., Dec. 15—The American Spring & Wire Co., of Camden, N. J., will open a plant in Holly for the manufacture of wire springs for automobile valves in the building used formerly by the Incubator Co. The site upon which the

MAKE FARM TRUCK

SIOUX FALLS, S. D., Dec. 16—Cap D. Jones Truck Manufacturing Co. has begun to assemble a 2-ton truck for farm use to sell at \$1,995, f. o. b. factory. The truck is composed of a Buda motor, Grant-Lees transmission, Borg & Beck truck, Bosch magneto, Stromberg carburetor, Spicer universal, is 3,280 chassis weight, 133 inch wheel base, front wheels 32 inches and rear 34 inches.

NEW KELLOGG FACTORIES

ROCHESTER, N. Y., Dec. 10—Work has been started on new factory buildings for the Kellogg Manufacturing Co., makers of engine driven tire pumps and automotive equipment. Adjoining the factory buildings a foundry will be erected which will supply the company with all its castings, and will do away with delays occasioned when this work was performed by outside foundries.

The new factory site is on the main line of the New York Central. All estimated production requirements for 1920 will be handled in the new buildings.

Calendar

SHOWS

January—New York, International Automobile Mfrs.' Congress.

Jan. 3-10—New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce. S. A. Miles, Manager.

Jan. 3-10—New York City. Eighth Coast Artillery Armory, commercial cars and accessories.

Jan. 8—Chicago. Airplanes. Manufacturers' Aircraft Association. Congress Hotel.

Jan. 17-21—Cleveland. Nineteenth Annual Automobile Show, Cleveland Automobile Mfrs.' and Dealers' Assn. Wigmore Coliseum.

Jan. 17-24—Hartford, Conn. Shows. State Armory. Annual Exhibition. Arthur Fifoot, Manager.

Jan. 19-24—Worcester, Mass. Automobile Show. Worcester Automobile Association.

Jan. 19-25—Milwaukee, Wis. Auditorium, Annual Motor Exhibition. Milwaukee Automobile Dealers' Inc.

Jan. 19-25—Oakland, Cal. Annual Motor Show. Alameda County Automobile Trade Association. Civic Auditorium. Robert W. Martland, Manager.

Jan. 24-31—Chicago, Ill., Coliseum. Cars: Drexel Pavilion, National Automobile Chamber of Commerce. S. A. Miles, Manager.

Jan. 24-31—Chicago. International Amphitheater, Commercial cars and accessories.

Jan. 31-Feb. 6—Kansas City, Mo. Annual exhibition, Overland Bldg. E. A. Peake, Manager.

Jan. 31-Feb. 6—Minneapolis, Minn. Annual automobile and tractor show, Overland Building.

Jan. 31-Feb. 7—Minneapolis, Minn. Twin City Automobile Truck, Tractor and Industrial Show. Overland Bldg.

Feb. 2-7—Toledo, Ohio. Annual Automobile Show, Terminal Auditorium.

Feb. 3-7—Baltimore, Md. Automobile Show. Baltimore Automobile Dealers Association. Fifth Regiment Armory. John C. O'Brien, Manager.

Feb. 3-7—Wilmington, Del. Automobile Show. Hotel duPont.

Feb. 9-13—Charlotte, N. C. Automobile Show. Charlotte Automotive Trade Association. Lee Folger, Chairman, Show Committee.

Feb. 9-14—Nashville, Tenn. Nashville Automobile Trade Association.

Feb. 10-15—Quincy, Ill. Annual Automobile Show.

Feb. 22-28—Ottawa, Ontario. Motor Show.

Feb. 21-28—Louisville, Ky. Twelfth annual exhibition, Louisville Automobile Dealers' Assn., First Regiment Armory.

February—Chicago. International Automobile Mfrs.' Congress.

February—Deadwood, S. D. Annual Show, Deadwood Business Club. F. R. Baldwin, Manager.

March 1-7—Springfield, Mass. Annual Automobile Show, Springfield Automotive Dealers' Assn. Harry Stacy, Secretary.

Mar. 10-13—Lebanon, Pa. Annual Motor Show. Automotive Trade Association of Lebanon. James Furniture Store Bldg. J. Paul Enck, Manager.

March 12-20—Boston, Mass. Annual Automobile Show, Mechanics' Building.

Mar. 15-20—Great Falls, Mont. Automobile Show. Montana Automobile Distributors Association.

FOREIGN SHOWS

January—Glasgow, Scotland. Scottish Motor Exhibition.

February—Manchester, England. North of England Motor Exhibition.

Feb. 22-March 6—Birmingham, Eng. British Industries Fair.

March—London, Eng. Motor Boat Marine and Stationary Engine Exhibition.

March—Adelaide, Australia. All Australian Exhibition of motor vehicles, airplanes, engines and automotive equipment.

March 1-15—Lyons, France. Automotive Products, Lyons Industrial Fair.

April or May—London, Eng. Commercial Vehicle Exhibition, Olympia.

April 3-May 4—Buenos Aires. Exposition of U. S. manufacturers.

TRACTOR SHOWS

Feb. 2-14—Wichita, Kan. Tractor and Farm Machinery Forum. Wichita Thresher-Tractor Club.

Feb. 16-21—Kansas City, Mo. Fifth Annual Kansas City Tractor Club. Guy H. Hall, Manufacturer.

CONTESTS

August, 1920—Paris, France. Grand Prix Race, Sporting Commission, Automobile Club of France.

June, 1920—Omaha, Neb. Reliability Truck Tour.

CONVENTIONS

Feb. 9-13—Louisville, Ky. Seventeenth Annual Convention American Road Builders' Assn., Tenth American Good Roads Congress, and Eleventh National Good Roads Show.

May 15-20, 1920—San Francisco. Seventh National Foreign Trade Convention.

S. A. E. MEETINGS

Jan. 6-8—New York. Annual Meeting.

Jan. 13—Chicago. Aeronautic Meeting, auspices Mid-West Section.

Jan. 28—Chicago. Truck and Tractor Meeting, Hotel La Salle.

Feb. 12—Kansas City, Mo. Tractor Dinner, Hotel Baltimore.

ARKAY OPENS OFFICE

NEW YORK, Dec. 15—The Arkay Sales Co., a selling organization, announces the opening of an office at 5 Columbus Circle, New York. Harry Ruben, formerly salesmanager of the Warner Lenz Sales Co., New York, and recently of the Republic Auto Parts Co., and William Kandle, formerly of the Warner Lenz Co., Chicago, are partners in the company.

ADDS TO FOREIGN STAFF

DETROIT, Dec. 16—The Kol-Ben Wheel Co., through its connection with the Automotive Products Corp., of New York, has increased its representation to cover all of the principal foreign markets. The company has large orders for export on file and several shipments already have gone forward.

H. E. Bradford is representing the company in England and Egypt and Arthur H. Hertz, is the representative in the Orient. The Scandinavian countries are taken care of by Boyce W. Knight while in Brazil and Latin-America S. H. Havlin looks after the company's interests. H. M. Gray takes care of the business in the United States island possessions and John R.

Duggan is the New Zealand representative.

Resident salesmen in the various foreign countries include Chas. H. Voight, Jose A. de Lavelle, John F. Hutson, G. J. Kluyskens, C. S. Vought, K. A. Orbanowski, and A. C. Dowden.

Expansion Planned

NEW YORK, Dec. 16—to take care of largely increased business, The Federal Bearings Co., Poughkeepsie, has started construction on an addition to their plant. When this is completed in the early Spring, factory capacity and production will be more than doubled. An increase in capital stock from \$1,000,000 to \$2,000,000 has also been announced. A certain part of this new stock will be sold to finance the expansion.

COAST TO COAST MAIIS

WASHINGTON, Dec. 15—Aerial of the present airplane mail service from New York to San Francisco and other Pacific Coast points would be authorized by a bill introduced into Congress by Representative Ramseyer. The bill authorizes the Postmaster General to expend \$730,000 for the extension of aerial mail.

GET MICHIGAN CHARTERS

DETROIT, Dec. 6—The following corporations have been granted charters in Michigan:

Stout Engineering Laboratories, Inc. Detroit, \$10,000; research and development of automotive industries, William B. Stout, president.

Owen Park Automobile Co., Detroit, \$10,000; general garage business, Charles D. Cutting, president.

Crary Manufacturing Co., Detroit, \$50,000; to manufacture and sell automobile accessories, Cecil R. Crary, president.

Struble Manufacturing Co., Ecorse, Mich., \$12,500; to manufacture and deal in motor vehicles, motors and parts, R. R. Wallace, president.

Continental Tool Works, Detroit, \$60,000; to manufacture and sell machine tools, S. F. Wall, president.

Motor Cartage Co., Detroit, \$50,000; carting and hauling as private carriers under particular contracts, James O. Brown, president.

Increases in capital stock were granted as follows:

Detroit Transportation Truck Co., \$5,000 to \$50,000; L. B. Orloff Co., Detroit, \$50,000 to \$150,000; Mt. Clemens Trucks Body Co., Mt. Clemens, Mich., \$14,000 to \$30,000; Saginaw Overland Sales Co., Saginaw, Mich., \$15,000 to \$50,000.